

AN ESSAY



ON

PHYSIOLOGICAL PSYCHOLOGY.

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TO

DR. WILLIAM B. CARPENTER, F.R.S.

ETC. ETC.

MY DEAR SIR,—Impressed with the conviction that to you, more than to any other physiologist or metaphysician of the age, belongs the honour of having placed the great doctrines of Mind on the solid basis of a sound Physiological Psychology, I have much pleasure in dedicating to you the attempt made in the following Essay to expound some physiological points in connexion with our mental constitution, which you were among the *first* to enunciate; and, at the same time, in having such an opportunity as this presents, not merely for recording my sense of the value of your psychological labours, but of acknowledging the advantages and the pleasure which I have derived from your private friendship and social intercourse. . .

That you, my dear Sir, may long be spared to your family and to science, is the ardent hope and fervent wish of yours sincerely,

ROBERT DUNN.

PREFATORY NOTICE.

THE following chapters on Physiological Psychology have appeared as a series of Papers in the "Journal of Psychological Medicine and Mental Pathology," edited by Forbes Winslow, M.D., D.C.L. Written at varying intervals amid the distractions of medical practice, I am sensibly aware that they bear too evident marks of needless repetitions, and of a want of unity in the treatment of the subject; and yet these were perhaps in a measure unavoidable, under the circumstances of their composition. There is reason, however, to believe that these papers have proved a *stimulus to thought*, and have roused into activity the energy of other minds of high endowments, possessing more leisure and better opportunities than I can command for successfully prosecuting such an interesting inquiry; and this belief has led to their republication in a separate form. Of the importance of the subject, and of its practical bearings upon Psychological Medicine, there can be no dispute, for surely it is on Mental Physiology, and a knowledge of the Correlations of Physiology and Psychology, that a rational and enlightened practice can alone be based. Besides

"E cœlo descendit, γυναι̃ σεαυτον."

and physiologically or psychologically considered, *self-knowledge* is equally important.

R. D.

PHYSIOLOGICAL PSYCHOLOGY.

CHAPTER I.

Genesis of the Mind.—*Consciousness, an ultimate Fact; a succession of States.*—*Self-Consciousness, the Primary Condition of Intelligence.*—*Phenomena and Nervous Apparatus of the Sensational Consciousness.*

IT is no longer a subject of dispute, that the doctrines of mind rest essentially on the basis of our physiological composition—that they form a part of the physiology of man. For, however it may be attempted to separate intellectual and moral from animal and corporeal man, and however we may reason about our intellectual and moral nature apart from our bodily and animal constitution, it is never to be forgotten that they are united in this life, forming one and a composite system of mutual dependence and reciprocal action. From the first moment that *the primitive cell-germ* of an human organism comes into being, and is launched upon the ocean of time and space, it may literally be said, that the entire individual is present, that an organized entity exists, fitted for a human destiny; and that, from the same moment, *matter and mind, body and soul*, are never for an instant separated. Their union constitutes the essential mode of our present existence, and they are alike subject to the laws of development and growth; for the mind, like the body, passes through its phases of development. Not only is the framework and different organs of the human body evolved and perfected, one after the other, in accordance with all the subsequent wants of the future man; but, among the rest, and from the same primitive cell-germ, are gradually developed, the nervous apparatus and the encephalic ganglia, upon the vesicular matter of which the mind is dependent for the manifestation of all its activities. And thus we see, that in the primitive cell-

germ of the human organism are potentially contained the *vital*, *nervous*, and *mental forces*; and, than the attempt to investigate and trace the genesis and gradual development of these forces, and their correlations with each other, what subject, to the psychological inquirer, can be more interesting or more important?*

The phenomena of the vital force are first displayed. For in the cell-germ, duly supplied with the nutrient pabulum, inherent are the powers of self-development and life under which the human fabric is evolved and built up. But after birth, to the organic processes, the animal functions and their allied appetites and instincts are superadded; and with these, sensations, as subjective conditions, are inseparably connected. Man then enters upon a new state of being and an individuality—an independent existence is established. For as soon as embryonic life is passed, the *nascent consciousness* becomes awakened,—roused into activity by stimuli from without, the senses coming into play from the moment of birth.

Now, consciousness is an *ultimate fact* in animal existence, beyond which we cannot go; it is the *distinguishing* attribute of animal life, the first of the phenomena of the *mental force*, and *self-consciousness* is the primary condition of intelligence: in a word, *it is mental existence*.

The great and fundamental mystery of life, indeed, consists in the relations of consciousness and of that dynamical agency which we designate *volition*, or the *will*, to the functions of the special senses, and those of the encephalic ganglia, which connect man as a sentient, percipient, and intelligent being, with his own bodily organization and with the world without. For, while it is no longer a matter of dispute that the encephalon is the material organ of the mind, where the ultimate molecular changes precede mental states, and from whence the mandates of the *will* issue,—it has been well observed, by an acute metaphysician, that,—

“As to the nature of the relation which exists between the encephalon and the sentient and percipient mind, we never shall be able to understand more than is involved in the simple fact, that a certain affection of the nervous system precedes immediately a certain affection of the mind. And that a peculiar state of the particles of the brain should be followed by a change of the state of the sentient mind is truly wonderful; but, if we consider it strictly, we shall find it by no

* The subject has engaged the attention of one of the ablest physiologists and most profound thinkers amongst us—I mean Dr. Carpenter. See his valuable paper, in the “Philosophical Transactions of the Royal Society,” On the Mutual Relations of the Physical and Vital Forces; and his chapters On the Correlations of Physiology and Psychology, in the last and fifth edition of his “Human Physiology.”

means more wonderful than that the arrival of the moon at a certain point in the heavens should render the state of a body on the surface of the earth different from what it otherwise naturally would be. We believe, and, indeed, with as much confidence, that one event will uniformly have for its consequent another event, which we have observed to follow it, as we believe the simple fact that it has preceded it in the particular case observed. But the knowledge of the present sequence, as a mere fact to be remembered, and the expectation of similar future sequences, as the result of an *original law of our belief*, are precisely of the same kind, whether the sequence of changes be in the *mind* or in *matter*, singly or reciprocally in both.*

The essential nature of mind is a problem which belongs to the same category as the nature of life. We know nothing of life apart from organization; and we have no evidences of mind independent of a brain and nervous system. An organism is required for the display of vital phenomena, and an encephalon for the manifestations of mind. Life has accordingly been defined as "the collective expression for a series of phenomena which take place exclusively in bodies that are organized," and mind as "the functional power of the living brain."

But be it remembered, in affirming that sensation, perception, emotion, thought, and volition are functions of the nervous system, it is only maintained that the vesicular matter of the encephalic ganglia furnishes the material conditions, the substratum through which these mental phenomena are manifested, and that at the same time it is fully admitted the *essential phenomena of matter and mind* are so completely antagonistic, it is in vain that we attempt to establish any relationship of analogy or identity between them. But we have more satisfaction in the consideration of *mind*, in the light of *force*, and in the contemplation of the correlations of the forces of the physical, vital, nervous, and mental, for we see that the *nervous* and *mental* forces are constantly interchanged and interchangeable. We note the perpetually-recurring metamorphosis of *nerve-force* into *mind-force*, and of *mind-force* into *nerve-force*, and the important *physiological fact* that the nervous matter of the cerebrum is the material substratum through which the metamorphosis is effected. Nay, more; we have actual proof of an *increased disintegration* of the nervous tissue in the *redundant amount* of the *alkaline phosphates* in the urine, when the centre of intellectual action has been over-taxed. And in all our voluntary movements and volitional acts we see the dynamical agency of *mind* producing *motion*, and that of the will, through the in-

* Dr. Brown's "Lectures on the Philosophy of the Human Mind." Lecture XIX.

strumentality of the *nerve-force*, acting upon the muscular system.

Dr. Carpenter has well observed :—

“ We have evidence in what we know of the physiological conditions under which *mind* produces *motion*, that certain forms of the *vital force* constitute the connecting link between the two ; and it is difficult to see that the dynamical agency which we term *will* is more removed from *nerve-force* on the one hand, than *nerve force* is removed from *motor force* on the other. Each, in giving origin to the next, is itself suspended, or ceases to exist *as such*, and each bears in its own intensity a precise relation to that of its antecedent and its consequent. But we have not only evidence of the excitement of *nerve force* by *mental agency* ; the converse is equally true, *mental activity* being excited by *nerve-force*. For this is the case in every act in which our consciousness is excited through the instrumentality of the sensorium, whether its conditions be affected by impressions made upon the organs of sense, or by changes in the cerebrum itself, a certain condition of the nervous matter of the sensorium being (we have every reason to believe) the immediate antecedent of *all consciousness*, whether *sensational* or *ideational*. And thus we are led to perceive, that as the power of the will can develop nervous activity, and as nerve force can develop mental activity, there must be a *correlation* between these two modes of dynamical agency, which is not less intimate and complete than that which exists between the nerve-force on the one hand, and electricity and heat on the other. This idea of *correlation* of force will be found completely to harmonize with those phenomena which indicate the influence of physical conditions as the determination of mental states, whilst, on the other hand, it explains *that relation* between emotional excitement and bodily change which is manifested in the subsidence of the former, when it has expended itself in the production of the latter.”*

Now, of consciousness as an ultimate fact in animal life—the first of the phenomena of the mind-force—we can best conceive in relation to time, as an incalculably rapid succession of acts or states, and as passing through a series of successive developments from the moment of birth. Purely sensational at first, it emerges gradually, *step by step*, from self-consciousness, through the perceptive and emotional to the higher phases of intellectual consciousness, until the mind reaches its dominant development in the perfect freedom of volition or the will.

But these progressive phases of mental development are dependent for their very existence upon the evolution and material condition of the vesicular matter of the encephalic ganglia through which they are manifested.

Comparative psychology, the study and strict interpretation of

"the living experiments (to use the happy and expressive language of Cuvier) which nature has presented to us in an ascending series, in the varying forms of animal existence," from the lowest up to man, not only establishes the fact that sensation, perception, emotion, and intellectual action, are distinct states of consciousness, successively developed, but that these states are manifested through different portions or nervous centres of the encephalon, and that the human mind in its progress to maturity passes through these successive phases of development.

Man is at birth the mere creature of sensation and instinct, so that sensational consciousness and consensual and instinctive actions constitute the earliest stage of his psychological existence. The senses come into play from the moment of birth, and they soon acquire the utmost perfection of which they are capable, but their intentions are strictly consensual.

All our actions are automatic, reflex, consensual, and instinctive, until the perceptive consciousness has been developed. But with the perceptive consciousness we have its associate memory, and the genesis and development of the will. We attain to the free exercise of volitional power, and to the performance of purely voluntary actions. With the perceptive consciousness emotional sensibility is indissolubly connected; for we see the expression of joyous emotion in the infant's laughing eye, as the perceptive consciousness begins to dawn, and as the powers of recognition and volition are awakened; and though long before we can reason or reflect we manifest the emotional and social instincts, no one can take upon himself to say at what precise moment the infant eye ceases to convey a mere nervous impulse, and when it awakens in the mind the first glimpses of the sublime and beautiful.

The ratiocinative and reflective consciousness are the last developed and the latest to reach maturity. As sensation is the earliest and lowest, so is ratiocination the latest and the highest of our mental attributes.

Sensational Consciousness.—Sensation is the link in the chain of being between the vital and mental forces, connecting indissolubly together the conscious and the unconscious processes. As a complex act it lies partly within and partly without the consciousness, and as soon as embryonic life is passed, it traverses the line which separates the physical and vital from the nervous and mental processes, enters the light of consciousness, and thus becomes a fact, psychological as well as physiological.

As a subjective condition, sensation is identical with simple consciousness, and the two great and distinguishing functions, typical of animal life, namely, sensation and locomotion, are seated in the sensory and motory ganglia of the nervous system.

Now, sensori-motor, consensual, and instinctive feelings and actions formularize the sensational consciousness; and in its simplest but essential type, the nervous apparatus of the sensori-motor, or sensational consciousness consists of a series of nervous centres or ganglia, and of internuncial conductors, or of commissures and nerves. The vesicular matter of the nervous centres or ganglia is the source of the nervous force, where impressions are received and impulses are generated; between these centres the commissures are the media of communication, and to and from them the nerves are internuncial conductors or cords.

In the invertebrate subkingdom is best seen the simplest form or apparatus of the sensational consciousness, namely, distinct ganglia, with commissural cords and nerves, administering to the functions of automatic life and to the operations of instinct. But in the nervous system of the invertebrata, we have the homologues of the sensational consciousness of the vertebrate series; for the sensory ganglia are the seat of the sensational consciousness of whatever kind, and the cranio-spinal axis the source of all the movements of the body, the two great centres of sensation and motion being brought into harmonious and associated action through the medium of the cerebro-spinal axis. In man, and throughout the whole of the vertebrate subkingdom, the sentient and sensori-motor apparatus, the system of automatic life, and instinctive action subservient to sensations, and to those consensual and instinctive actions which are indissolubly linked-on with sensations, consist of the spinal axis and nerves, the medulla oblongata, and the chain of sensory ganglia, including those of the special senses at its summit. For if we follow up the cranial prolongation of the spinal cord, the medulla oblongata, into the fibrous strands of which we see imbedded the *respiratory, auditory, and gustatory ganglia*, and carefully trace out its ramifying branches, we find it sending off distinct fasciculi of fibres to the ganglionic centres at its summit, to the cerebellum, the corpora quadrigemina, the thalami optici, the corpora striata, and to the peduncles of the olfactory ganglia. And thus we see, to the *sole exclusion of the cerebrum*, whose connexions are *strictly commissural*, that the whole series of the ganglia of the cerebro-spinal system, including those of the special senses, are in direct fibrous connexion with the cranio-spinal axis, and form with it, as an aggregate or whole, the *sensorium commune*, or *great circle of sensational consciousness and of consensual and instinctive action*.

Now, the sensori-motor, consensual, and instinctive phenomena, which formularize the sensational consciousness, though the lowest in the psychical scale, are independent of, and ought not

to be confounded with, intelligent and volitional actions. For while we recognise in the nervous apparatus, through which these phenomena are manifested, the homologues of the sensational consciousness of the vertebrata, and even of man himself, we find that the motor centres of the articulata, and the sensory of the mollusca, are alike destitute of those crowning and special ganglia, *the cerebral hemispheres*, which are the seat of the perceptive consciousness, of intellectual action, and volitional power. It is admitted that there is no point in physiology more clearly made out than that the cerebrum, or great hemispherical ganglia, is the centre of intellectual action and volitional power, the seat of the understanding and the will.

But in myriads of animals, indeed in the whole of the invertebrate subkingdom, with the exception of the highest mollusca, the cuttlefish, *no cerebrum exists*; and, even in the lower vertebrata, the olfactory, optic, and auditory ganglia have no direct connexion with it, so that the totality of their life is made up of sensational consciousness, and of reflex, consensual, and instinctive actions. And such, too, is the primitive condition of man in the first stage of his existence, for at birth all his acts are reflex, consensual, and instinctive, and generally among the first roused into activity by the effects of the external stimuli of his environment, is that of crying very lustily; and next to this follows the untaught motions of the lips in the act of sucking, to satisfy an internal want and instinctive feeling. The instincts, the untaught activities and capacities of our animal nature are *innate*. As internal subjective feelings, they arise in obedience to certain laws of our nature, or are brought into play in direct correspondence to stimuli acting upon the sensational consciousness from without. The infant mind responds solely at first to impressions from *without*, or from instinctive feelings from *within*. The sudden light, indeed, may dazzle, and a loud noise may startle; but until the perceptive consciousness has been awakened, the mind is in a state of isolation,—it takes no cognizance of an *outward world*. To it the inward world is everything, and the outward world is nothing. Its sensations are all subjective, and its actions reflex, consensual, and instinctive. But even in adult life the functions of the cerebrum may become suspended, and man reduced to his primitive condition of mere sensational and instinctive being. When the functions of the cerebrum are thus benumbed and paralysed, and when it is no longer capable of receiving and acting upon sensorial impressions, it is then that the sensory ganglia, as an independent centre of action, becomes so strikingly manifest. An interesting and instructive instance of this kind was for some months under my observation about ten years ago. But having pub-

lished the narrative, with a commentary on some of the most important of its psychological bearings, I need here merely observe, it was the case of a young woman, in whom the intellectual faculties were quite suspended, and whose only open avenues to the sensational consciousness were those of *sight* and *touch*, for she could neither hear nor speak, taste nor smell.*

Among the functions of the sensational consciousness, common sensibility or feeling, and the capability of experiencing pleasure and pain from mere tactile impressions, are primordial, the most universal in nature, and the most essential to human existence. Some, indeed, have maintained that all the other special senses are but modifications of that of touch. This notion of Democritus, of which the fallacy is obvious, we can readily conceive had its origin in the observed fact of the *necessity of contact* in the operations of all the senses, between the physical impulse and the external organ of sense. Thus in sight, where the eye is the organ, and light the medium, the rays must impinge upon the retina; and in hearing, the vibrations of the air must strike upon the tympanum. So, too, in taste and smell, the sapid and odoriferous particles must be brought into actual contact with the papillæ of the tongue, and the pituitary membrane of the nose. But all this merely points to a community of action in their mode of operation, whilst the fallacy consists in overlooking the all-important fact, that each of the sensory ganglia of the external senses is the seat of a *special endowment*, and that each conveys to the sensational consciousness a different kind of intelligence. Thus, when electricity is brought to bear upon the eye, it excites a consciousness of light, upon the ear of sound, upon the nose of smell, upon the fingers of a prickly feel, and upon the tongue of an acid or alkaline taste. These functions are not interchangeable.

"The eye cannot detect the noxious atoms arising from a putrid animal; the ear is unaffected with the contents of its own ministering fluid, however heavily laden with scents; the hand cannot finger the fragrance of the rose, nor the tongue taste one of the hundred perfumes which may be served up in a parterre of flowers."†

We cannot see with our tactile organs, hear with our visual, nor smell with our auditory

Special Senses.—The external senses have been emphatically styled the "Alphabet of Intelligence." They are the inlets to the materials of knowledge, and constitute, with their allied, con-

* "Physiological Psychology. A Case of suspension of the mental faculties of the powers of speech, and special senses, with the exception of sight and touch, continuing for many months; with a Commentary on some of the more important of its bearings, upon the Philosophy of the Human Mind and the Physiological Psychology of Man." By Robert Dunn, F.R.C.S. Eng. London: T. Richards, 37, Great Queen-street. 1855.

† "British Quarterly Review." April, 1855.

sensual feelings, appetites, and instincts, the inferior region of the true or conscious mind. They occupy a prominent, not to say predominant, part of the mental life, of the great mass of the inferior animals, and a very considerable portion of the far more complicated thread of human existence. Each of the sensory ganglia of the special senses, in the encephalon, conveys to the sensational consciousness a different kind of intelligence, and they are obviously the seat of the simple feelings of pleasure and pain, inseparably connected with the exercise of their functional endowments, as well as the centres and source of those motor impulses, which once evoked, react upon the muscular system, independently of volition or thought. But the intuitions of the senses are strictly consensual, and confined to the sensible phenomena of matter, without conveying to us any knowledge whatever of the bodily substance with which they may be connected. Thus we see light, we hear sound, we smell odour, we taste savor, and we feel pain, heat, or cold. To these intuitions Oken has given characteristic designations. He calls touch or feeling the *earth sense*; sight, the *light sense*; hearing, the *motion sense*; smell, the *air sense*; and taste, the *water sense*.

Mr. Wedgwood has well observed :—

“It is hardly necessary to premise that we have no knowledge of *body* by any of the five senses. What I immediately perceive by sense is the *sensible phenomena* itself, and not the bodily substance with which it may be locally connected, either as the proximate cause of the sensation, or as the organ by or in which it is felt. When I suffer toothache, or when a pin is run into me unawares, the thing of which I have actual apprehension is the pain I suffer, not the bodily substance of the pin and the tooth. When a gun goes off before my window, what I hear or perceive by the ear is neither the bodily gun nor the vibrations of the air, by which the material action is conveyed to my ear, but the sound itself. When I gaze upon the stars, the visible image before my eyes affords a subject for contemplation, apart from all speculation as to the bodily nature of the object seen. Thus the exercise of the senses displays to us five elementary *modes of being*, logically unconnected with the bodily substance. Five kinds of being upon which we may think, independent of all intellectual reference to bodily support.”*

The special senses have been classified and grouped in the order of their importance into the superior or *psychical*, and the inferior or *animal*, the former comprehending feeling, seeing, and hearing, and the latter taste and smell. This arrangement is in perfect accordance with the varying character of the commissural relations of their sensory ganglia in the encephalon, and is strikingly exemplified in that of feeling or touch.

* “Cambridge Philosophical Transactions.” Tract by H. Wedgwood, Esq., quoted by Mr. Morell, “Elements of Psychology.”

Touch.—Of all the special senses, touch is the most important, for it is the most essential to human existence. It is the most universal in its application, and forms the starting-point to all the rest, combining to a certain extent all their functions, and enabling us gradually to replace the loss of the other senses, by manifold comparisons, but being itself never replaced by any combination of them. Its mode of action is best illustrated by the simple notion of *resistance*, and it is through its agency that we acquire distinct conceptions of the physical qualities of bodies, such as their hardness, softness, roughness, smoothness, &c.*

As the peripheral extremities of all the different spinal nerves, diffused and ramifying upon the entire superficies of the body, administer to the sense of touch, and as these impressions are transmitted from the posterior segmental ganglia of the spinal cord upwards along the sensory tracts to the thalami optici, it has been legitimately inferred that these bodies are the encephalic ganglia of tactile and common sensation. Still, as the sense of touch is both *subjective* and *objective* in its bearings—at one time the source of physical pleasure, and at another the awakener of intellectual ideas,—the subjective phenomena have been separated from the objective, or tactile sense, and designated, *par excellence*, *feeling*, or *common sensation*; and while this has been seated in the thalami optici as its encephalic centre, the tactile sense has been referred to the corpora dentata* of the cerebellum, and which, it must be admitted, are in direct commissural connexion with the posterior segmental ganglia of the cord along which the tactile impressions are transmitted.

Pathological researches have produced the conviction in my own mind that the corpora dentata are the seat of the *muscular sense*, and the thalami optici, that of *common sensation* and *tactile feeling*. We cannot deny to the little lancelet (*the amphioxus*) which may be viewed in the light of a connecting link between the vertebrate and invertebrate series of animals, the possession of *common sensation* or *tactile feeling*; and yet we know that, in its case, no cerebellum exists, and, in conse-

* By Dr. Noble, of Manchester. Vide his "Elements of Psychological Medicine." As bearing upon this point, I would refer to a "Case of Tubercles in the Brain, with Remarks, Physiological and Psychological, on the functions of the Nervous Centres involved in the Disease," which I published in the *Association Medical Journal* (pp. 712-16). 1854.

At the autopsy, there was found in the lateral lobe of the cerebellum on the left side, a mass of tubercular deposit a little to the outer side of the median line, in a state of softened degeneration, and during life the following diagnostic phenomena were noticed in the child:—"There was an imperfect paralysis of the right side, both of the arm and leg, but still they responded to the mandates of the will: she could move her arm about, and could grasp anything firmly enough in her right hand, when her eyes and attention were directed to it; but, if they were diverted to something else, and the volitional power withdrawn, she would let the object which she had been holding fall from her hand, and without being conscious of the fact."

quence, that the corpora dentata are wanting. But the thalami optici are not simply the great encephalic centres of common sensation, where the sensory strands of the medulla oblongata terminate. They are, in reality, the common centre and point of union of the sensory nerves. Implanted upon the sensory tracts of the crura cerebri and medulla oblongata, they are in direct fibrous commissural connexion with the respiratory, gustatory, and auditory ganglia, and with the optic nerves, by a direct passage of a portion of their roots, and with the peduncles of the olfactory nerves, through the medium of the fornix; so that a connecting nervous thread ramifies throughout the entire circle of special sensation, and the thalami optici form a *common foci and point of union* to all the nerves of special sense. And this harmonizes well with the universality of the feeling, or common sensibility, which pervades the entire system, and which is associated with all the voluntary movements of the body, and the exercise of the functions of all the other special organs of sense.

"Without some point of union, some fixed reality, running like a continuous thread through all the phenomena of the special senses," it has been well observed by Mr. Morell, that, "our whole sensational life would be a succession of mere impressions, each point of existence being distinct from the other, and each removed sensation like a momentary life and death of the whole individual. In this chaos of impressions, accordingly, and around a middle and uniting point, they all tend to cluster; order begins to ensue; a connexion between the phenomena of the different senses manifests itself, and the shadow of a continuous life, of which these impressions are but the passing phases, is projected from out of the dark confusion.

"This shadow is the first rise of *self-consciousness*—the middle point of our phenomenal existence—the unity around which all our sensations, from the earliest period, are gradually marshalled. Accordingly, the primary form of self-consciousness is the *unity of sense*."*

And thus, as the encephalic ganglia of common sensation, and the centre and point of union of the nerves of special sense, we see what an important part the thalami optici play in the great circle of sensational consciousness and instinctive action. But their office does not end here. When we come to the consideration of the perceptive consciousness, from their intimate relations with the cerebrum and corpora striata, the centres of intellectual action and voluntary motion, we shall find what an important office the thalami optici sustain in operations which rank high in the psychological scale.

Sight and Hearing.—Next to touch or feeling, sight and hearing are the most important of the senses. They have been viewed in contrast. Intellectually, *sight is knowledge*, and

* Morell's "Elements of Psychology."

hearing, attention. To see is to know, and to hear is to listen. Sight is the clearest and hearing the deepest of the senses. The visual impressions on the retina pass at once to the perceptive consciousness, while the pathos of the orator appeals directly to the deepest feelings and emotions of the soul. Hearing is feeling, and tone moves us. An external object shows its outward surface; but it is the tone or sound which it sends forth that betrays what exists within. It is not the form or colour of an object which tells what it is, but its sound.

Sight.—Sight is the highest, most refined, and objective of all the senses; for sight is knowledge. I need not dwell upon the importance of the sense; but, at first, it is nothing more than an overpowering sensation of light, no object being individually distinguished.

The corpora quadrigemina are the encephalic centres of vision, though some physiologists have restricted the function to the corpora geniculata; and it must be admitted that, like the thalami optici, the corpora quadrigemina have a higher and wider sphere of action; for, like them, they are associated with our emotional states, and they are not the mere ganglia of sight; their commissural relations in the encephalon are commensurate with the importance of their functions, and their direct connexion with the seat of the muscular sense,—the corpora dentata in the cerebellum,—is just what *a priori* reasoning would lead us to expect, seeing how invariably in health all our voluntary movements are under the direction and guidance of sight as well as feeling.

Hearing.—The sensory ganglia of the auditory nerves are embedded in the posterior pyramids, in the sensory tracts of the medulla oblongata, and their commissural relations well accord with the psychical and emotional character of the sense of hearing. It is more subjective than that of sight,—for hearing is feeling, and it administers more largely to our sensuous feelings. We hear succession—continuous sound being the result of a succession of impulses, communicated from without to the auditory nerves. It is a refined kind of touch. Objectively considered, hearing is motion; intellectually, it is attention; for to hear is to listen. It is one of the most important inlets to knowledge, and is associated with our instinctive, emotional, and intellectual states. The sensations of sound, when wrought into music, are the sources of infinite pleasure; and who can estimate the marvellous influence of articulate speech!—the magic of the human voice!

“The world of sounds is scarcely less important than the world of sights. All the rich varieties of tone, all the diversified notes of nature; from the whisper of the wind to the crash of the thunderbolt;

from the massive Harmonies of Handel, to the gentle wail of the parting spirit as it sings the flesh to sleep!"*

Taste and Smell.—Taste and smell are the animal senses, and are intimately connected with the organic sensations of the alimentary canal. They administer to the most important purposes of animal life, but are more subservient to our physical comforts and welfare than to our intellectual development.

Taste is the chemical sense, and the gustatory ganglia, through which we acquire a knowledge of the sapid qualities of substances, are embedded in the sensory strands of the medulla oblongata with the nuclei of the glosso-pharyngeal nerves and a portion of the sensory roots of the fifth. Of all the senses, taste is most allied to that of touch, or common sensation. It has no special nerve of its own, like smell, or sight, or hearing. But it is proved beyond dispute, that the *gustative impressions*, which excite nausea and vomiting, are conveyed to the medulla oblongata exclusively through the glosso-pharyngeal nerves; and as nausea and other tastes do become idealized, the sensory impressions must pass up to the thalami optici, and through those channels reach the perceptive consciousness.

Taste penetrates to the chemical constitution of bodies, and it has for its object the selection of food, and the excitation of the flow of the saliva. It is the steward of the stomach, and smell is the guardian of the lungs. They are co-operators.

"The toil of eating is a pleasure; a sense is stationed at the gateway of the alimentary canal, and endowed with the power of enjoying the substances required by the frame for its support. When a sapid substance comes in contact with the tongue, its papillæ rise up like a little army, as if to examine the intruder. This Inspector-General of Taste divides them into three classes, the *insipid, unpalatable, and positively agreeable*. It tells us how the external world *tastes*, and right skilfully does it do so. A beautiful accord subsists between the tongue and the stomach. The warden of the lodge knows what visitors will visit his colleague in the hall of digestion. Rightly used, the sense of taste is a gift of the most benevolent description."

†

Smell is the air sense. Like a sanitary guardian at the portal of the lungs, it tests the purity of the air we breathe, and is closely allied to taste.

"As sentinel at the gateway, it reports to the mind when it finds any suspicious perfumes abroad. The nose is the official inspector of nuisances. It strains the air for the lungs, and it tests the poison which may be suspended in that essential fluid."

‡

The instinct of *self-preservation* is the most universal instinct in nature, and the very first that is roused into action. To it all the special senses are subservient, but first and foremost, those

* "British Quarterly Review," April, 1854.

† Ibid.

‡ Ibid.

of smell and taste. Smell is its first and guiding sense, for it is the sense of smell which attracts and guides the human infant to the mammary gland of its mother to satisfy an *internal want*, or *craving*.

I have alluded to the commissural connexions of the peduncles of the olfactory nerves with the thalami optici, the *great centres of sensorial feeling*, the foci and point of union of all the nerves of special sense, but they are also directly connected with those primitive basilar convolutions of the cerebrum which surround the *fissura Sylvii*, and which are coeval in point of existence with the fissure itself.

The impressions both of taste and smell become *idealized* and registered. We all know by experience how a savoury ~~cause~~ cause the mouth to water, and how a noxious and ~~effluvia~~ effluvia will induce nausea and a sickening feel; but it is not equally true that the very thought of them, the mere ~~recollection~~ recollection of the *idealized sensations*, will produce the same effect.

But besides the impressions from the special senses, and the simple feelings of pleasure and pain associated with the exercise of the functional endowments of their sensory ganglia, there are various classes of sensations and subjective feelings appertaining to our bodily states which are brought under the cognizance of the sensational consciousness;—such are the sensations of organic life, and of the appetites and instincts. With the animal processes sensations are inseparably connected, and with sensations their allied appetites and instincts. But sensations are the primary phenomena, and form the starting-point to the other two; for it is obviously manifest that an appetite or instinct must be preceded by or attended with a sensation. Sensations are either pleasurable or painful, but pain is the exception, and the indirect, and not the direct effect of the actions of life.

There is the pleasurable consciousness which constitutes the feeling of health, but there is also a feeling of sickness, of lassitude as well as of vigour, and a great variety of painful subjective feelings, arising from particular states of the muscles, as shuddering, twinging, spasms, cramp, &c., and which are conveyed by afferent nerve fibres to the sensorium, and thence to the sensational consciousness, awakening a consciousness of our bodily states.

There is a general feeling of *well-being*, and one of *malaise*, in common language known as “the state of the spirits;” and this state of *self-feeling*, or *camæsthesia*, is of a varying character, and greatly influenced by the bodily temperament. Some there are—

“So keenly susceptible of both conditions, that they pass their whole lives in an alternation between *cheerfulness* and *depression*, the former state being favoured by freedom from anxiety, by the healthy activity

of all the organic functions, by a bright sun, and a dry bracing atmosphere, whilst the latter is immediately induced by mental disquietude, by a slight disorder of digestion or excretion, or by a dull, oppressive day. In such individuals, favourable conditions may even exalt the anæsthesia into *exhilaration* or *absolute joy*, whilst the combined influence of opposite conditions may produce *gloom*, which may be exaggerated almost to *despair*. The condition of 'the spirits' most to be desired is that of *tranquil comfort*, for this is far more favourable than the alternation of extremes to healthful activity, and to sustained energy, both of body and mind."*

* Dr. Carpenter's "Human Physiology."

Sir Henry Holland has published some admirable papers—On the Effects of Mental Attention on Bodily Organs, in his "Medical Notes and Reflections," and in his chapters on Mental Philosophy, well worthy of the attention of the medical philosopher and observant practitioner.

CHAPTER II.

Sensation and Perception; distinct States of Consciousness.—Genesis of the Will in the Perceptive Consciousness.—Review of the Nervous Centres of the Encephalon, and Specification of their Functions.—Development of the Cerebrum, and Classification of its Convolutions.—Organs and Phenomena of the Perceptive Consciousness.

THE scientific procedure of psychology, according to Fichte, essentially consists in separately considering the *intelligence*, the *feelings*, and the *will*, and in carefully observing and studying their parallelism in the different stages of mental development. We have considered the unity of the mind in *self-consciousness*,—its earliest, and consequently lowest, phase of development—in *sensori-motor*, *consensual*, and *instinctive feelings and actions*; where the *intelligence* is purely sensational, the *feelings* simply those of pleasure and pain, and the *impulses to action* inherent and instinctive.

We have now to consider it in the *perceptive consciousness*, the next stage of our psychological progress, in *ideation*, *emotion*, and *volition*; and here, too, there exists a perfect unity at the root, from these being so closely interwoven with each other. For without ideation there can be no determinate or voluntary action, and without the will no act of intelligence; while alike with both and with either, emotional sensibility is indissolubly connected.

The genesis of the will is in the perceptive consciousness, and it proceeds, *pari passu*, with the development of the intellectual faculties, until they reach their dominant development—the highest reason and the freest will;—and then it is that an act of the will embodying the whole man emphatically implies, at the same time, *intelligence*, *emotion*, *impulse*. But when the perceptive faculty is in abeyance, the will is in abeyance, and memory is abolished. Of this we had a striking illustration in the young woman's case, to whom I have before alluded. In her the mental faculties were quite suspended, and all the avenues to the sensational consciousness were closed, with the exception of sight and touch, for she could neither hear nor speak, smell nor taste. Her mind was in a state of isolation, and even through sight and touch no *ideas* were aroused, for the

perceptive faculty was in abeyance, but the will was in abeyance also, and memory she had none. "She had no notion that she was at home, nor the least knowledge of anything about her. She did not even know her own mother, who attended upon her with the most unwearied attention and kindness. Wherever she was placed there she remained throughout the whole day, making not the slightest *voluntary* effort of any kind, manifesting no uneasiness for anything to eat or to drink, and taking no heed whatever of what was going on around her." In fine, while the perceptive faculty was benumbed and paralysed, *ideation*, *memory*, and *volition* were alike abolished.

Perceptive Consciousness.—Sensory impressions, the intuitions of the special senses, whether sights, sounds, smells, tastes, or feelings, internal or external, in order that they may reach the perceptive consciousness, and so become *idealized* and *registered*, require to be transmitted from their respective sensory ganglia to the great hemispherical ganglia, or cerebrum, for it is there that *ideation* is effected, and *memory* resides. But if, indeed, the perceptive faculty should become suspended, then "all the enjoyments of the feast, all the fragrance of the flowers, and the whole of the associations which they embody, vanish as with a single and magic stroke."* And, as in this young woman's case, the most nauseous medicines would be taken quite as readily as the most delicious viands. Such, too, is the fate of all our associations in connexion with the higher and more objective of the senses, with *hearing*, *feeling*, *sight*. For the whole world of tone,—the grandest harmony, the softest melody, the living voices of nature,—exist not when the percipient power is in abeyance; nor without its agency can our tactile sensibility impart to us any knowledge of the bodily substances by which we are impressed, or identify the impressions with the forms of the external objects that produced them. And as for light—to what do the intuitions of light and colour amount without the perceptive faculty, and what the pictured image on the retina without the perceptive organ beyond it? To the eye, without the perceptive faculty behind it, "the universe would be all dark and dreary, not a tint or a hue there, not a smile on the face of nature, nor a shade of beauty on the summer's landscape."† And thus it is that perception is the portal to intellectual action; for while in *sensation*, the conscious mind feels intuitively the physical impulse of the outward object as it affects the consciousness through the sensorium, in perception the nervous impression is carried a stage farther, and by virtue of the harmony which exists between the percipient mind and the external world or nature, the sensory impression is intuitively translated into the form of intelligence,

* Morell's Psychology.

† Ibid.

and becomes an intellectual phenomenon; in other words, it is *perceived* and *idealized*. The process in both cases is equally and alike intuitive. For when we look at an external object, we can no more avoid the perception that it is a something distinct and apart from ourselves, and of having forced upon our minds intuitive ideas as to its size, shape, colour, &c., than we can reject the sensations of touch, as to its hardness or softness, or those of taste as to its sweetness or bitterness, or of smell, as to its fragrance or offensiveness; in each and in all, the process is alike intuitive. But these two states, nevertheless, of consciousness,—*sensation* and *perception*,—though both intuitive and so closely allied, are not to be confounded, for they are *distinct*, and the mechanism (so to speak) of their action is *different*. The one is a single, and the other a complex act. In *sensation* it is direct and single, for the impressions made on the sensory ganglia go direct to the sensational consciousness; but *perception* is a step in advance in our psychological progress, *above* sensation, and in it a double ganglionic action is involved. For the sensory impressions to become *perceived*, that is, *idealized* and remembered, they require to be transmitted from the sensorium to the cerebrum, “the sole receptacle,” in the language of Cuvier, “where the various sensations may be, as it were, consummated, and become *perceived* by the animal, and where all sensations take a distinct form, and leave lasting traces of their impressions, serving as a seat to memory, a property, by means of which the animal is furnished with materials for its judgments.”*

In illustration of this view, Dr. Noblet has well observed:—

“An anatomical distinction between the region of *thought* and that of *sensibility* can very fairly be established; and a certain aptitude, moreover, can be recognised in the encephalic structure for conveying the impressions of the senses upwards to the hemispherical ganglia. White matter intervenes between the vesicular neurine of the sensory ganglia and that of the cerebral convolutions; the conscious impressions received by the former may be regarded, as ascending along the white fibres, and, on the gray summit being attained, developing changes in its condition which minister to intelligence. *Ideas arise*. If we reflect upon the processes that go on within our own minds, there is no difficulty in distinguishing between a *sensation* and an *idea*, or in marking the sequential origin of the latter. How often do we find that, when the full consciousness of sensation is obtained, the idea suggested by it does not follow until some seconds, or even minutes afterwards. For example, you hear the utterance of certain words as sounds; their signification does not strike you; no effort of

* Cuvier, *Rapport sur le Mémoire de Flourens sur le système nerveux*, quoted by Dr. Todd. *Vide* “Cyclopaedia of Anatomy and Physiology, and Functions of the Nervous System.”

† *Vide* Dr. Noble's Lectures “On the Co-relation of Psychology and Physiology,” page 27.

attention is made, yet suddenly the sense breaks upon your intelligence. The correlated physiological phenomena may be thus stated. The auditory ganglia take up the sentient impression at once; its passage onwards to the seat of thought is delayed; presently, however, its natural course is freed, as if from some hindrance, and it attains the hemispherical ganglia, forming or awakening ideas in the mind.”*

* The *modus operandi* of Anæsthetic agents, in relation to their action upon the different nervous centres of the encephalon, is highly interesting and instructive. It brings strong confirmation to the important facts, that sensation and perception are *distinct states* of consciousness, that they have their seat in different nervous centres, and that the *sensational consciousness* may be suspended, while the *perceptive* remains intact. As bearing on these points, I brought the subject of “*the inhalation of chloroform, its anæsthetic effects, and practical uses*,” under the notice of the Royal Medical and Chirurgical Society, in a paper, which was read and discussed, April 22, 1851, and afterwards published in the *Medical Gazette* of the same year. In illustration, I may here cite the following paragraphs:—

“There can be no doubt that the anæsthetic effects of the inhalation of the vapour of chloroform are due to its entering the circulation, and to its being carried by the blood to the vesicular matter of the sensory ganglia, and to the cells, or cell nuclei, at the peripheral extremities of the afferent nerves. And while it is reasonable to infer that, in thus circulating with the blood through the encephalon, its presence, like that of any similar morbid agent, must more or less affect all the sensory feelings and psychical manifestations, it is nevertheless abundantly manifest that a kind of elective affinity exists, by virtue of which the vesicular matter of one centre of action becomes affected before that of another; for, during the slow and gradual inhalation of the vapour, the function of sensation is suspended before that of intellectual action,—the *consciousness of feeling* is obliterated, and consequently immunity from pain secured, before *intellectual consciousness* is totally abolished. M. Flourens was, I believe, the first to point out the tendency of certain morbid agents to act primarily and specially on one nervous centre in preference to that of another, by virtue of some special elective affinity between such agents and certain ganglia of the encephalon.

“From the records of personal experience, and from a careful consideration of the phenomena observed in others, we may trace the following order and sequence in the effects of the inhalation of the vapour of chloroform, properly diluted, upon different nervous centres.

“Thus, the first few inhalations are attended with *feelings* which indicate disturbance in the action of the sensory ganglia, as ‘singing in the ears, a sense of numbness, and tingling of the surface of the body,’ &c., but which are soon succeeded by a *transient stage* of more general excitement; of delirium in the hemispherical ganglia, for instance,—as singing and incoherent talking, and of excited emotional impulses, and consensual movements in the *sensory ganglia*,—as laughter and uncontrollable motorial actions; this is speedily followed by suspension of the function of sensation, the *consciousness of feeling*, while as yet some degree of *intellectual activity* remains. Sensorial impressions *from without* are no longer transmitted from the sensory ganglia to the cerebrum; but this ‘suspension of ordinary sensational impressions, as in sleep, with persistent intellectual activity, is the typical characteristic of dreaming;’ and dreams often occur. The commissural fibres, between the cerebrum and these ganglia, *Reil’s nerves of the internal senses*, being still in action, they transmit downwards the *residual intellectual activity* from the cerebrum to the sensory ganglia, and frequently give rise to manifestations, which impress the mind of common observers with the belief of pain and suffering being felt under the knife of the surgeon, while in reality there are none.

* “The function of the cerebrum as the centre of intellectual action is next suspended; a state of coma is induced, a *complete abolition of consciousness*, reducing life to a series of automatic movements. After this the medulla oblongata and true spinal centres become involved, reflex action is stopped, and breathing by the ribs suspended. The ganglionic system is the last to be implicated; but, with the arrest of the peristaltic action of the heart, life ceases.”

Before entering, however, upon the consideration of the phenomena of the perceptive consciousness, and of the local habitation of its organs in the cerebrum, I think we shall proceed with decided advantage, in reference to the physiological bearings of the subject, seeing that throughout the entire vertebrate sub-kingdom, the type of the brain is the same,—if we first pass in review the whole of the ganglia of the encephalon, and endeavour to specialize their functions, beginning with the lowest of the vertebrate series, and thus “making use of the lower animals, as so many experiments ready prepared to our hands by nature.” In man, indeed, the cerebrum is so enormously developed, that it completely overlaps and crowns the other encephalic ganglia, whilst in the lowest of the series its representative is reduced to a mere lamina or crust. Now, proceeding in this way, if we advert to the brain of the fish, the lowest in the series of the vertebrate sub-kingdom, and where there exists the least complexity of structure, what do we find? And of what are the ganglionic bodies which we do find, the *homologues* in the human encephalon? We find, in the brain of the fish “a series of at least four distinct ganglionic masses, arranged in a line continuous with the spinal cord, three of them in pairs, and the last or hindmost single.” Respecting these, a rigid scrutiny and a strictly philosophical induction has fully established the following important deductions—viz., that the first of these masses—the most anterior on either side of the median line—is the olfactory ganglia, the centre in which the olfactory nerve terminates, and in connexion with the anterior extremity of the medulla oblongata.

The second pair are the sole representatives of the cerebral hemispheres, but not in their totality. The exterior covering only indicates the presence of the anterior lobes, for the interior mass, from its connexions and aspects, is the homologue of the corpus striatum.

The third are the optic lobes, the ganglionic centres of the optic nerves, which contain the homologues of the corpora quadrigemina and thalami optici of the higher vertebrata. The fourth and single mass, placed over the divergent space of the fibrous strauds of the medulla oblongata forming the fourth ventricle, is the cerebellum, sometimes having rudimental lateral appendages. Now the fact is indisputable, that in the early human embryo, as in the brain of the fish, the encephalon consists of a like series of distinct ganglionic bodies, amongst which the representatives of the cerebral hemispheres are usually the smallest. We have—

1st. The olfactory ganglia.

2nd. The corpora striata, covered by their laminae, which are the rudiments of the cerebral hemispheres.

3rd. The thalami optici, inclosing the third ventricle.

4th. The corpora quadrigemina, and

5th. The cerebellum.

It has been truly observed by Dr. Carpenter,—

“There is no more general fact in the whole range of comparative anatomy, than that the encephalon of the vertebrata is composed of *these elements*, at the commencement of its development, and that the whole history of the evolution of the human brain indicates its precise accordance with this general type of structure.”

But a searching scrutiny unfolds and demonstrates that the same distinctness exists in the nervous centres or ganglionic bodies, in the *adult brain*, as in the *embryonic*; and that the greater complexity of structure in the former is entirely due to the size and development of the cerebral hemispheres, and to their extensive commissural connexions with the other encephalic ganglia, and of those ganglia with each other.

But, adverting again to the brain of the fish and to that of the human embryo, we see that the first of the ganglionic bodies—the olfactory—are in direct fibrous connexion with the medulla oblongata; and, in the adult brain of the human subject, as I have already observed, the peduncles are also connected with the thalami optici, and with the primitive and fundamental convolutions of the cerebrum which surround the Fissura Sylvii.

In the second pair of ganglia, alike in the brain of the fish and in that of the human embryo, we find the corpora striata in close connexion with the rudimental cerebral hemispheres, forming, in fact, rounded masses with them. Now, this fusion, as it were, or rather, bending up together in the same mass, of the *motor* with the *perceptive centre*, is interesting and instructive, inasmuch as it not only indicates the closeness of their union, but presents to us, in the case of the fish, the *earliest instance* to which we can point of clear and distinct evidence of the exercise of *perception, memory, and volitional movements*, as opposed to *mere consensual actions*. But waiving, for the present, the further consideration of the *perceptive faculty* and its *cerebral organ*, I would observe, that I hold it to be indisputably established—and my own pathological researches have confirmed me in the opinion—that *the corpora striata are the motor ganglia of the encephalon*. Implanted upon the motor tracts of the crura cerebri and medulla oblongata, *in them the motor fibres terminate*; and they thus, with the vesicular matter of the locus niger and the anterior segmental ganglia of the spinal cord, constitute the motor axis of the cerebro-spinal system, and are the source of all the movements of the body, whether reflex, consensual, emotional, or voluntary.

The corpora striata are not the *seat of volition itself*; but the encephalic motor centres, through which the mandates of the will or volitional power of the hemispheres are propagated—the connecting links of thought with action,—of the mental with the motor forces. Their commissural connexions with the cerebrum are so intimate and so extensive, that they are evidently placed in subserviency at every point, through the agency of innumerable radiating commissural fibres, to the volitional power of the hemispheres, in every voluntary act and effort. And thus we find, in hemiplegic patients, that the imperfect power of utterance which we so constantly meet with, is due to some structural lesion, either in these commissural fibres, or in the motor centres,—the corpora striata, through which the volitional impulses operate in speech. But the corpora striata are not solely the motor centres of volition. From their close commissural relations with the thalami optici, they are also and equally the centres and channels of respondent sensori-motor actions, and of consensual, instinctive, and emotional movements.

Dr. Todd and Mr. Bowman have clearly shown that there exists between the corpora striata and the thalami optici a relation analogous to, and as close as, that which subsists between the *anterior* and *posterior* peaks of grey matter in the cord; and as, in the case of the spinal cord, the anterior peaks, or segmental ganglia, issue motor impulses in response to sensations excited through the posterior peaks,—so, too, in the case of the encephalon, the corpora striata propagate motor impulses in response to excited internal feelings and emotions, of which the thalami are the seat, and often quite independently of volition or thought.

The spinal cord itself, though in such intimate, direct, and continuous connexion, through the medium of its cranial prolongation,—the medulla oblongata,—with the corpora striata and thalami optici, is nevertheless manifestly a *distinct and independent centre of action*, consisting of a series of segmental ganglia and nerves, structurally homologous, and functionally analogous to the jointed ganglionic cord of the articulata. The excito-motory and reflex actions of which it is the seat, are evidently subservient to the conservation of the organism, by the excitation of the respiratory movements, by the governance of the various orifices of ingress and egress, and by the maintenance of the integrity of other vital processes in which the reflex movements are concerned. And while I would here give free expression to my admiration of the genius of that able and acute investigator and discoverer, Dr. Marshall Hall, in his capacity alone of expounder of the *doctrine of reflex action*, and of its practical application in the elucidation of morbid symptoms and to thera-

peutics, and to my conviction of the great obligation which medical science lies under to him, I cannot plead ignorance of the fact, that many of our most eminent physiologists are opposed to his hypothesis, of the *existence of a distinct and special system of incident and reflex nerves for the production of excito-motory actions*. They maintain that muscular movements, whether reflex, emotional, or voluntary, are immediately called into action by the *same afferent nerve fibres*, and that the very *same efferent or excito-motory fibres* are alike the channels for the transmission of stimuli which give rise to reflex actions in the cord—and of impressions which become sensations when transmitted to the sensorium. Nor is reflex action peculiar to the true spinal system; for it is equally an attribute of the sensori-motor, emotional, and cerebral systems.*

But, to proceed. The third pair of ganglia are the optic lobes. In the brain of the fish, the optic thalami and corpora quadrigemina are contained in one mass, forming these lobes, and presenting, in point of magnitude, a striking contrast to their rudimentary cerebral hemispheres. This fusion is interesting and instructive, and harmonizes well in fishes with the activity of their sight, and the character of their consensual movements. In the human embryo, however, the vesicles are distinct; and the thalami optici, in the adult brain, to use the words of our great physiologist, Sir Charles Bell, "forms a nucleus around which the corpus striatum bends." The thalami are the essential ganglia of the *sensory* tracts, as the corpora striata are of the motor. Implanted upon the sensory tracts of the crura cerebri and medulla oblongata, *in them the afferent fibres terminate*. They are the great centres of sensibility, for they are in direct and continuous commissural connexion with the posterior segmental ganglia of the spinal cord; and the impressions which are received by these ganglia from the sentient extremities of all the different nerves distributed upon the whole surface of the body, pass up to the thalami, and there become sensations. But they are not thus the mere centres of *common sensation*; for, as we have already seen, a continuous nervous thread ramifies throughout the entire circle of special sensation, so that the thalami are the common foci and points of union for all the sensory nerves; and this harmonizes well, as I have before observed, with the universality of the feeling, or common sensibility, which pervades the whole system, and which is associated with all the voluntary movements of the body, and with the exercise of the functions of all the other special organs of sense. In a word, the thalami optici are the *great centres of sensorial*

* *Vide* Dr. Laycock's paper "On the Reflex Function of the Brain," read at the meeting of the British Association, held at York, 1844.

feeling,—those points of unity around which our sensational feelings, from the earliest period, are gradually marshalled, in the development of self-consciousness,—the primary form of which essentially consists in this unity of sense.

The thalami optici have a yet more important office, and are associated in operations which rise still higher in the psychical scale. With Dr. Carpenter, I believe them to be the seat of those inner sensibilities and feelings which are associated with the emotional states.

Lying within the band of the corpora striata, the thalami, like these bodies, are in most intimate and extensive relationship with the cerebrum, through the instrumentality of innumerable fan-like commissural fibres,—Reil's nerves of the internal senses,—the *connecting links of thought with feeling*, and of *ideation with emotion*.

Along these channels, sensory impressions are transmitted upwards from the thalami to the perceptive organs, for *ideation and registration*; and from the cerebrum, ideas, thoughts, and the workings of ideo-dynamical, emotional, and mental agencies, pass downwards to them, there to receive these varying hues and shades of *feeling*; for, as Dr. Carpenter justly mentions, *thought bears to feeling—the cerebrum to the thalami*—the same relation which the physical impressions upon the organs of the external senses bear to the special endowments of their sensory ganglia in the encephalon; for instance, as in the sense of vision, the retina of the eye to the corpora quadrigemina.

I cannot dismiss the consideration of the thalami optici and corpora striata, *the great encephalic centres of sensibility and of motion*, without citing the authority of Dr. Todd. To Dr. Noble's hypothesis, that the corpora striata, with the optic thalami, form the special region of emotional sensibility, I do not subscribe:—

"The anatomy," says Dr. Todd, "of the corpora striata and optic thalami, while it denotes a very intimate union between them, also shows so manifest a difference in their structural characters, that it cannot be doubted that they *perform essentially different functions*. In the corpora striata the fibrous matter is arranged in distinct fascicles of different size, many, if not all of which, form a special connexion with its vesicular matter. In the optic thalami, on the other hand, the fibrous matter forms a very intricate interlacement, which is equally complicated at every part. Innumerable fibres pass from one to the other, and both are connected to the hemispheres by extensive radiations of fibrous matter. The corpora striata, however, are connected chiefly, if not solely, with the inferior fibrous layer of each crus cerebri; whilst the optic thalami are continuous with the superior part of each crus, which is situate above the locus niger. It will be observed, then, that while these bodies possess, as a principal character in common,

their extensive connexion with the cerebral hemispheres, or, in other words, with the convoluted surface of the brain, they are, in the most marked way, connected inferiorly *with separate and distinct portions of the medulla oblongata*; the corpora striata with *the inferior planes of the crura cerebri and their continuations, the anterior pyramids*; and the optic thalami with *the olivary columns, the central, and probably fundamental portions of the medulla oblongata*. And this anatomical fact must be taken as an additional proof of their possessing *separate functions*.

"Now, it may be inferred, from their connexions with nerves chiefly of a sensitive kind, that the olivary columns and the optic thalami, which are continuous with them, are chiefly concerned in the reception of sensitive impressions, which may principally have reference merely to informing the mind (so to speak) or partly to the excitation of motion, as in deglutition, respiration, &c. The posterior horns of the gray matter of the cord, either by direct continuity with the olivary columns, or their union with them through commissural fibres, become part and parcel of a great centre of sensation, whether for mental or physical actions; and this leads us to view the thalami optici as the *principal foci of sensibility*, in intimate connexion with the convoluted surface of the brain, through its extensive fan-like radiations, and without which the mind could not perceive the physical change resulting from a sensitive impression. Again, the pyramidal bodies evidently connect the gray matter of the cord (its anterior horns?) with the corpora striata; and not only these, but also the intervening masses of vesicular matter, such as the locus niger, and the vesicular matter of the pons and of the olivary columns; and, supposing the corpora striata to be the centres of volition in connexion with the convoluted surface of the brain by their numerous radiations, all these several parts are linked together for the common purposes of volition, and constitute a great centre of voluntary actions, amenable to the influence of the will at every point."*

The fourth pair of vesicles in the human embryo are the Corpora Quadrigemina; but these are not simply the ganglia of vision (which function, as I have previously observed, some physiologists have restricted to the corpora geniculata); for, like the thalami optici, they have a higher and a wider range of action, and are manifestly the seat of those *objective emotional feelings and motor impulses*, which are roused into activity through the agency of sight. Of this fact we have daily and familiar illustration and proof in the infant's laughing eye, and in its expression of joyous emotion, as the perceptive consciousness begins to dawn; we see it in the effect produced by making strange faces at young children; we hear it in their scream of excited alarm, and we behold it in the convulsive fit, or shuddering agitation, which sometimes follows. Now, it is worthy of remark, that,

* "Physiological Anatomy and Physiology of Man." By Dr. Todd and Mr. Bowman. Pp. 347, 348.

in the brain of the fish, the corpora quadrigemina and the thalami optici are contained in one mass, forming the optic lobes; and this fusion, or binding up together of these ganglionic centres, is instructive, as indicating, at least, the closeness of the union, if it does not establish an identity of function. In the case of the young woman to whom I have already referred, in whom the intellectual faculties were in a state of abeyance, and whose only media of communication with the sensational consciousness were through *sight* and *tactile feeling*, or *touch*, we have in evidence, that through either of these channels, equally and alike, feelings of terror and of fright were *most* readily exerted; and assuredly this points to a *common centre* as the seat of these feelings, or to an *identity* and *unity* in the functions of the ganglionic centres concerned—the corpora quadrigemina and thalami optici. A more striking illustration, perhaps, cannot be found upon record, of the susceptibility to emotional excitement, than this young woman's case presents, at a time when the mental faculties were quite suspended.

And in relation to it, I may here reiterate what I have elsewhere stated, that

“While, on the one hand, it is abundantly manifest that the corpora quadrigemina are the seat of those *objective emotional feelings* and *motor impulses* which are roused into activity through the instrumentality of sight, I think, on the other, we may fairly, and are entitled to infer, that the thalami optici—the seat of our inner sensibilities—are the common centres of all our *other objective* and *subjective feelings*, and *motor impulses*, associated with the emotional states.”*

For though it cannot be denied that simple emotional feelings and motor impulses may be, nay, easily and constantly are, excited and roused into activity, through all the special senses, by impressions from without, it must never be forgotten that the thalami optici are the common foci of sensibility for all the nerves of special sense,—the points of unity around which our different sensations are marshalled, and where they all centre and meet.

The Cerebellum is the last in the series of the encephalic ganglia. Placed over the divergent strands of the medulla oblongata, and consisting of a median lobe and two lateral appendages, it is in most intimate connexion with the apparatus of automatic life. In the adult brain no part of the encephalon has such extensive connexions with the cerebro-spinal axis, for it is in union with each segment of the great nervous centres upon which the sensations and movements of the body depend, but it has *no direct connexion with the cerebrum*.

* “Physiological Psychology,” page 36, *ante cit.*

The complexity of its structure induces the belief of a plurality of functions. The restiform columns derived from the posterior strands or columns of the spinal cord, there is every reason to infer, have the same endowments as the rest of the sensory tracts; and if the corpora dentata be the ganglionic centres in which they terminate, they must be centres of sensation closely allied to that of common or tactile sensation. *They are the seat of the muscular sense*; and, as Dr. Carpenter has suggested, the cerebellum may only react (by reflex action) upon the impressions submitted to it, without being itself the instrument of communicating such impressions to the consciousness.

Comparative anatomy, pathological researches, and experimental inquiry, alike establish the position that the office of the lateral lobes of the cerebellum is the co-ordination of voluntary and locomotive actions; and whilst, on the one hand, the direct structural connexion which subsists between these co-ordinating organs—the lateral lobes and the corpora quadrigemina—clearly indicates the importance of the guiding influence of the visual sense in co-ordinated movements, so, on the other hand, analogous to this, is the influence of the restiform bodies, as channels for the transmission upwards to the corpora dentata, of impressions appertaining to the muscular sense.

The median lobe of the cerebellum is primitive and fundamental, exercising an independent function, since in the lower classes of the animal series up to birds, *the lateral lobes do not exist*. Pathological investigation has led me to espouse the opinion of Serres, that the median lobe is *the sensory ganglion of the sexual instinct*. Nor to this allocation of the generative propensity—which must be admitted to be one of the most universal instincts in nature, having for its object the perpetuation of the species—can I see a single valid *anatomical or physiological* objection, but on the contrary, from the intimate relations of the median lobe with the centres of sensation and emotional feeling, and through them with those of intellectual action, a clear and satisfactory explication of the complex character of the amative propensity in man.*

* I brought this view of the subject under the notice of the Royal Medical and Chirurgical Society, in a paper on "A Case of Apoplexy of the Cerebellum," read March 13, 1849, and published in vol. xxxii. of the Society's "Transactions." The case was that of a printer and publisher, fifty-two years of age, who died suddenly in an apoplectic attack, after having eaten a hearty dinner. At the autopsy there was found in the interior of the right hemisphere of the cerebellum an apoplectic clot, of the size of a pullet's egg, from a rupture of one of the branches of the vertebral artery. The whole arterial system of the brain was more or less in an unhealthy state, presenting that diseased condition of the vessels, which results from cartilaginous and ossific deposition between their coats. The interior of the hemisphere had become a softened pulpy mass, and the softening had extended inwardly beyond the centre of the median lobe, implicating the fibrous strands of the

And it may truly be said that—

“An instinct of absolute necessity in its object is thus rendered a principle of our moral constitution, and connects itself with all our

middle and inferior planes in the destructive process, and outwardly so near to the surface of the hemisphere, that a portion of the apoplectic clot was projecting through it.

Five months previous to the fatal seizure, he had a slight attack. I then found him low and exhausted, with a feeble pulse, and a cold clammy perspiration upon the surface of the body, complaining of sickness of stomach, and of pain, heat, and uneasiness in the back part of the head. He rallied in the course of the day, but the pain, heat, and uneasiness of the head continued for some days afterwards. There was no paralysis, but there was about him a hurriedness of manner, great restlessness, and irritability of temper. A few days afterwards, his wife told me, with great delicacy and embarrassment of manner, that he had become the subject of a constant desire for sexual intercourse. His behaviour in this respect was so different from what it had been, and so little amenable to persuasion or reason, that she said necessity had induced her to speak on the subject to me. I at once recommended his removal from home, and succeeded in persuading him to pay a visit to some friends in the country, without his wife, on the plea that a change of air and scene was essentially necessary for the re-establishment of his health. He was absent about three weeks, and returned apparently improved in his general health, and no longer a slave to the sexual propensity. In this respect he had greatly changed. The desire for sexual intercourse had abated, and from that time it gradually became less and less up to the period of his death, while, at the same time, there was observed an unsteadiness in his gait, which visibly increased, and amounted at times, under the influence of emotional excitement, to the staggering of a drunken man; and, for some time before he died, he had a settled weakness and stiffness in the left leg and foot.—The condition of the cerebellum viewed in connexion with the history of the case, is full of interest. For while it is obvious that such an extensive disorganization of its internal structure must have destroyed the integrity of the functional powers of the part, it is highly interesting to note, during the progress of the degeneration, first, the exaltation and subsequent depression of the generative function, and, secondly, the tottering gait, from the defective power of co-ordination, ending in a weak and stiffened limb. As the extraordinary excitement of the sexual passion was a sudden invasion, and as this was manifested so soon after his first attack, the inference appears to be indisputable, that it was a consequence of that attack, and dependent upon the *co-relative stage* of that destructive disturbance of the cerebellum which led to such extensive degeneration of its structure. This is not the only case in which, from personal observation, I have been able to associate exaltation and subsequent depression of the sexual propensity with opposite pathological conditions of the cerebellum; the first with irritation and incipient inflammatory indications, and the latter with degeneration and abscess.

In one instance which came under my observation some years ago, the patient, though dotingly fond of his wife and children, and in every other relation of life an exemplary man, could not restrain the sexual passion; and I had him two or three times to treat for gonorrhoea,—on one occasion during the period of his wife's accouchement. He wept over his delinquencies. In his case, at the latter period of his life, and after all erotic manifestations had passed away, he had not only a tottering, but a stooping gait, and required a walking-stick for support in progression. After death, there was found an extensive softening in the middle and in one of the lateral lobes of the cerebellum, as well as superficial ulceration of the glans penis, and atrophy of the genital organs. During the past year, an interesting case of tubercle of the brain in the adult came under my notice; and not the least remarkable of its features was the excited state of the generative function in the latter period of the patient's life. He died in a state of coma, from serous effusion at the base of the brain. In him the symptoms were so well marked, that during life tumour or tubercle on the brain was diagnosed. At the *post mortem* inspection, there was found, underneath the tentorium, quite unattached, excepting

moral responsibilities, while, at the same time, it furnishes materials for those powers of imagination, taste, and perception of beauty, which, if not altogether peculiar to man, are at least his possession in degree infinitely above all that can be admitted into the comparison.*

After this general review of the nervous centres of the encephalon, we may now revert to the consideration of the crowning ganglia of the whole series—the *cerebral hemispheres*, the seat of the perceptive consciousness, of intellectual action, and volitional power,—in a word, of the understanding and the will. In the lowest of the vertebrate series of animals, the representatives of these hemispheres are limited to the anterior lobes, and reduced to mere lamina or crusts. But they gradually increase in size, complexity of structure, and in the number of their lobes and convolutions, as the animal rises in the scale of intelligence, until they reach their culminating predominancy in man. Professor Retzius, of Stockholm, has elaborately investigated the development of the cerebrum in the ascending vertebrata, and its different phases in the human embryo. His observations completely confirm the statements of Tiedemann and Serres as to the order in which the different lobes are evolved, showing that the *anterior lobe only* exists in fishes, that this enlarges as we ascend through the classes of reptiles and birds, but does not change its character; that the middle is not developed until we reach the mammalian class, presenting itself first in a very rudimentary form, and attaining increased development as we ascend; that the posterior lobe is developed from the back of the middle lobe, making its first appearance in the carnivorous group. To this history the embryonic development of the human cerebrum presents an exact parallel, the anterior lobe making considerable progress before the middle begins to be evolved, and the posterior being the latest in the order of succession.†

in its vascular connexions, a tubercular mass, about the size of a walnut, strikingly resembling the mulberry calculus, but having its base, which was about the size of a shilling, perfectly smooth; and corresponding to which was a depression, into which it was received, of some perceptible depth, on the surface of the left lobe of the cerebellum, very near to the median lobe. There was no lesion of structure, but all the surrounding parts were much congested. The pain was localized, and the paroxysmal attacks at times were very distressing. During life there was no paralysis, or loss of co-ordinating power. More than once he was urged to have a change of air and scene, but he would never stop away from home beyond a few days, as his wife could not accompany him—he had no enjoyment at night without her.

* Sir Henry Holland's "Chapters on Mental Philosophy," page 216.

† I would here take the liberty of suggesting to others, who are engaged in the practice of midwifery, and who feel interested in psychological inquiries, that they should allow no opportunity to escape them of inspecting the state and observing the phases of the embryonic development of the brain in cases of abortion, and thus of verifying, as I have had repeated opportunities of doing, some of the concurring statements of Tiedemann and Retzius, by the test of their own personal observation.

He gives the following account of the development of the cerebral hemispheres:—

"In the first period, which corresponds with the second or third months, only the anterior lobes form; in the second period, which is comprised in the end of the third, in the fourth, and in a small portion of the fifth, the two middle lobes appear, and after this time the posterior lobes. During a great portion of the first period, the descending horns of the lateral ventricles and the pedes hippocampi are wanting: these are added in the second period. During a great portion of the first period, the hemispheres do not cover the thalami optici; in the second period they completely overlap these parts, approach the large corpora quadrigemina, cover their anterior part, and then descend by the side of the cerebral nucleus (cone and stem), and, as it were, fold round it. If we examine a brain at this period of development, we might, from its external appearance, imagine that the posterior margin of the hemispheres corresponds to their persistent posterior ends and margin, that is, to those which are their posterior margins in their perfectly developed state. But it is not so. If we open the brain we come at once to the descending horns of the lateral ventricles, in which are the rudiments of the great pedes hippocampi. At a later period, in the fourth month, a small superficial notch is formed at the posterior margins of the hemispheres; and that part of the margin which is above the notch, is the first rudiment of the posterior lobes of the hemispheres. These, which are thus for a time only rudimental, begin above the middle lobes, gradually take in their posterior margin, follow it down, as development advances, by the sides of the cerebral nucleus, and terminate in that part of the *middle lobes* which meet the pedes hippocampi. Even in the brain of the mature fœtus, as well as in the fully developed brain of older persons, the posterior lobes are very clearly separated from the middle lobes by a branching furrow, which is especially distinct on the vertical side of the hemisphere which lies next to the *falx*."*

This tripartite division of the cerebrum into distinct lobes, and the order and succession of their development, are points of great psychological significance; for the observed facts clearly indicate that the cerebral lobes are evolved from *before backwards*, in the order and degree of their importance as psychical instruments, and they point to the middle and posterior lobes, but especially to the latter of these, with peculiar interest. It is only in man that we meet with such a great development *backwards* of the posterior lobes, and that the cerebellum is completely overlapped and covered by them. The anterior lobes are remarkable for their great extension *forwards*; but it must be conceded that the chief distinction between the cerebrum of man and that of the higher mammalia, is much more striking in reference to the *posterior* than to the *anterior* lobes. "The brain of the chim-

* Forbes's "British and Foreign Quarterly Medical Review," vol. xxii. p. 503.

panzee," says Professor Owen, "in the relative proportions of the different parts, and the disposition of the convolutions, especially those of the posterior lobes, approaches nearest to the human brain: it differs chiefly in the *flatness* of the hemispheres, in the *comparative shortness of the posterior*, and in the *narrowness of the anterior lobes*."

I am fully aware that some physiologists maintain that this tripartite division of the cerebrum into lobes is altogether arbitrary and useless; and it cannot be denied that it is quite impossible, when we survey the cerebrum from above, to point out where the second lobe ends and the third begins; for there is no breach in the continuity of the surface, but between the first and second the *figura Sylvi* presents a line of demarcation sufficiently distinctive, and on turning the base of the brain upward we at once see the meaning of these divisions.

* No one, however, can make any such survey of the brain, without being struck with the appearance and character of its convolutions.

A classification of these, begun by Professor Owen, has been greatly extended by M. Leuret; and it is much to be regretted that he did not live to complete his elaborate and valuable researches. The subject is one of great interest and vast importance; for it is an indisputable fact, that the complexity of these convolutions is an index to the place which the animal holds in the scale of intelligence. "Observation," says Leuret, "has shown what strict induction had led us to conclude, that each group of brains among animals has a type proper to it, and that the type is characteristically manifested by the form of its convolutions." Every family has a brain formed in a determinate manner; and the number, form, arrangement, and relations of the convolutions are found to be in strict accordance with the intelligence displayed. He justly makes a distinction between those convolutions which are *primary* and *fundamental*, and to be found throughout the whole series of convoluted brains, occupying the same position, and differing only in their size and extent,—and those *secondary* convolutions which are not constant, even in brains of the same group of animals, but are dependent upon the extent of the primary ones, and the connexions which they form with others that are near them.*

To determine the functions of the primitive convolutions is the great problem of physiological psychology, and as I have

* Gall was the first who classified the convolutions; and the labours of Gall, Spurzheim, and Holm in this interesting field of inquiry were great and valuable: and I would here take the opportunity of paying a passing tribute of respect to the memory of Mr. H. H. Holm, the friend and pupil of Spurzheim, who studied comparative cerebral anatomy with great enthusiasm. He was a Fellow of the Zoological Society, and, residing near the Society's menageries, he had easy access

elsewhere* observed, *it remains unsolved*. Nor is this surprising when we consider the conditions of the problem. We are required carefully to note the first appearance and progressive development of the primitive and fundamental convolutions from below upwards in the ascending series of animals, and to endeavour to analyse with certainty the characters of different animals, in relation to the objects of their intellectual faculties, in accordance with the cerebral convolutions as contrasted with mere consensual actions. Like things are to be compared with like, convolution with convolution, and the same groups in different animals with each other, before the problem can be solved.

All honour is due to Gall, for he was the first to enunciate clearly the true relations between the psychological nature of man and that of the lower animals; and while we claim for Unzer and Prochaska the defining of the boundaries of the *sensorium commune*, we must look upon Gall as the founder of physiological psychology. One of the most remarkable men of the age in which he lived, he was alike distinguished for originality and independence of thought, for powers of observation, untiring industry, and indomitable perseverance. To him and his able coadjutor, Spurzheim, medical science, as well as physiology and psychology, is under great obligations. And it is no deduction from their merits to reconsider, if not to remodel, the system of organology which they propounded, by the light which subsequent physiological inquiry and discovery have thrown upon the subject. In the prosecution of such inquiries, the inductive

to the collection, of which he availed himself, to study the habits and dispositions of the animals; and having permission to examine the crania and brains of those which died, his anatomical and physiological researches were rightly carried on.

Professor Owen, in his valuable paper "On the Anatomy of the Chetah," (*Pelis Jubata*), communicated to the Zoological Society on Sept. 10, 1833, and published in the first volume of the Society's Transactions, gives a note from Mr. Holm, containing his opinions of the functions of the different convolutions in the brain of the chetah, on a comparison of it with the human brain and that of some other animals. After an elaborate description of the brain of the chetah, Professor Owen says—"Of the constancy of the disposition of the convolutions represented by Gall and Spurzheim as characteristic of the brain of the feline genus, I was first assured by our fellow-member, H. H. Holm, Esq., Lecturer on Phrenology, whose attention has long been directed to this part of anatomy." Mr. Holm was a Member of the Royal College of Surgeons, but, enjoying an independence, he devoted himself to the pursuit of phrenology, instead of entering upon medical practice. His lectures were amply illustrated by casts, crania, and brains. He pointed out the cerebral convolutions which constitute the several organs, described the modifications which the convolutions receive, and compared them together to illustrate their magnitudes, positions, junctions, and outer connexions with great ability; and so highly did Dr. Spurzheim estimate his talents, knowledge, and zeal, that he made him the special depositary of his latest views on the configuration of the cerebral organs in man and the mammalia. Unfortunately, like Leuret, he was cut off in the midst of his labours, and in the fortieth year of his age.—*Vide* a Biographical Notice of Mr. Holm in vol. xix. "Phrenological Journal."

* "Physiological Psychology," page 48.

philosophy of Bacon must be our guide. For while it is never to be forgotten that a refined analysis discovered the harmony of the celestial motions, and conducted the immortal Newton through a maze of intricate phenomena to the great laws appointed for the government of the universe, it is melancholy to reflect for how many ages the opinions of one man were the measure of truth and reason, and, under the sovereignty of the sway of the Stagirite, how universal was the degradation of the human understanding.

But still it is gratifying after the lapse of ages to behold the father of experimental philosophy, the illustrious Bacon, clearly pointing out the absurdity of pretending to account for the phenomena of nature by syllogistic reasoning on hypothetical principles, and with a boldness becoming a genius of the first order, undertaking to give a new chart of human knowledge. Let us follow its guidance and tread in his footsteps. Already there are many labourers in the field, and much has been accomplished. A second Newton may arise among them to thread the labyrinth of metaphysical subtlety and transcendental philosophy with the logical acumen of a Locke, to collect and bind together the scattered and isolated links of the great chain of physiological discovery, to point out the bearings of the pathological facts of past experience, to interrogate nature herself upon the functional characters "written upon the nervous pulp" of the several ganglia, and to read her own replies in the living experiments which she has presented to us in the lower forms of animal existence, and thus to place the great doctrines of mind on the solid basis of a sound physiological psychology!

Since the enunciation of Gall, that the convolutions of the cerebrum are the seat of the faculties of the mind, their development and classification has been invested with peculiar interest.

"Anatomy," says Dr. Todd, "points to the conclusion that the office of the convolutions is connected with the functions of the mind; and it seems not improbable that the phrenological view which assigns to *certain convolutions* a special office connected with some particular faculty or faculties is true. This is strongly supported by the fact of a regular disposition of certain *primary* convolutions, and that, in tracing the convolutions from the most simple to the most complex, indications are found of the *persistence* of the *primary* and *fundamental* convolutions in the midst of many that are secondary and superadded ones."*

- * M. Leuret has shown, that in all the inferior classes of animals up to the lowest mammalia, the cerebrum is not convoluted on the surface. In the bat, the mole, and the rat, &c., as in birds, the cerebral hemispheres are perfectly plain and smooth, though

* Dr. Todd's "Cyclopædia of Anatomy and Physiology."

divided by the Sylvian fissure ; and among the earliest to appear, are the convolutions of the insula of Reil, in the *fissura Sylvii*. In the rabbit, beaver, and porcupine, the Sylvian fissure is strongly marked, but there are only a few slight depressions indicating the future sulci of the convolutions on the surface of the hemispheres. In the fox, wolf, and dog, the simplest form of the true convolutions are first met with,—the *fundamental convolutions of Leuret*. In the fox, as a typical example, they are six in number. Four of these are on the external surface, running from *before backwards* ; one forms the curved lip, or border of the Sylvian fissure, and surrounds the island of Reil ; the other three, also carried in this direction, are placed parallel to the first, and one above another ; the fourth or superior longitudinal, occupies the margin of the great longitudinal fissure ; the fifth, situated anteriorly, under the forepart of the anterior lobe, is the super-orbital convolution ; and the sixth is the great internal convolution, above the corpus callosum—la circonvolution de l'ourlet of Foville.

In the human brain, besides the great internal and the super-orbital convolutions, M. Leuret has represented *three external fundamental convolutions*, which are tortuous, and frequently communicate with each other. Between the anterior and posterior portions of these three external convolutions, are interposed, on the upper surface of the hemispheres, two sets of transverse convolutions, divided by a distinct sulcus, which runs outwards and forwards, from the longitudinal fissure, so that the right and left grooves form a V-shaped line, open in front, which is called by Leuret, the fissure of Rolando.

These transverse superior convolutions are peculiarly characteristic of the human brain ; and to this peculiarity must be added the elongation *backwards* of the cerebrum, by the increased development of the posterior lobe, and the greater and marked complexity of the vertical convolutions in the median fissure, and of those of the island of Reil.

In the development of the cerebrum, Foville has invested the *locus perforatus anterior*, or quadrilateral spot, with paramount importance, as being the central nucleus and fundamental part of the brain,—the starting point from whence the primitive convolutions are evolved ; and thus makes it the portal to intellectual action and volitional power.

Of the primitive convolutions he makes four orders, in each of the cerebral hemispheres, distinguishable one from another. Of these, the first order contains but one—the convolution of the band,—the ourlet or hem of the hemispheres,—the great internal convolution. It surrounds the hemispheres internally like a riband, and is attached at each extremity to the *locus perforatus*. It is clearly the basement convolution of the cerebrum.

The second order are the marginal convolutions, of which there are two. One, the great longitudinal convolution, occupies the circumference of the hemisphere, forming its excentric or outer boundary, while the other surrounds the insula of Reil and the *fissura Sylvii*. They arise from the quadrilateral space, and from the convolution of the band, from which they spring like buds from a branch.

The great marginal convolution of the longitudinal fissure forms the inner border of the triangular orbital surface of the anterior lobe, where cleft, as it were, in twain, it receives in a deep sulcus the olfactory nerve; the outer border of the triangular surface is formed by the marginal convolution of the *fissura Sylvii*, and at the apex of the triangle behind, the two borders are connected by a short and but slightly elevated convolution, bounding the locus perforatus anterior in front.

The convolutions of the third order, of which there are two sets, are situated on the *internal* surface of the hemispheres, forming a sort of anastomosis between the convolutions of the first and second order. These hook-like processes on the convolution of the band, led Rolando to call it *processo cristato*. The second set are within the *fissura Sylvii*, and constitute the insula of Reil.

The convolutions of the fourth order, the largest, deepest, and least symmetrical of all, are quite detached from the perforated spot, and have no *direct* connexion with the convolutions of the first order. They occupy, in a transverse direction, the outer or convex surface of the hemispheres, and they thus connect the two convolutions of the second order together—viz., the marginal convolution of the median fissure and that of the *fissura Sylvii*. They are especially characteristic of the human brain, and may be considered "as prolongations of the convolutions of the third order, below the two convolutions of the second order, and running directly across the upper surface of the brain."*

We may now proceed to the determination, if we can, of the organ of the perceptive consciousness in the cerebrum, and then resume the consideration of the phenomena which formularize the perceptive consciousness—namely, ideation and volition, with their associates, memory and emotional sensibility. Perception is the correlative of sensation, and indicates its intellectual phase; for, in this second stage of our psychological development, we have *intelligent ideas, emotional feelings, and volitional actions*.

I quite agree with Dr. Todd, that the psychologist must determine what are and what are not fundamental faculties of the mind, before the physiologist can venture to assign to each its local habitation in the brain. But about the perceptive con-

* Solly "On the Brain," page 136.

consciousness there can be no dispute, and to my mind, quite as little about the existence of a central organ in the cerebrum, as its local habitation and instrument—the seat of ideation and volitional power. In the nervous apparatus of the sensational consciousness, we have seen that there is a central organ—a point of unity around which the various sensations are marshalled, and that the thalami optici are these central foci of sensibility, “without which the mind could not perceive the physical changes resulting from sensitive impressions.” So, too, the perceptive consciousness has its central organ, where ideation is effected, whence issue the mandates of the will, and where sensory impressions—the intuitions of the special senses—are translated into the form of intelligence, and become intellectual phenomena—are perceived and associated, and where the intuitions of one sense are used to correct and elucidate those of another. But the question recurs, Can we determine the site of the organ of the perceptive consciousness? Do embryology and comparative anatomy afford us any clue to the solution of the question, or throw any light upon the subject? I think they do. For if we revert to the phases of embryonic development, we find, about the tenth week, that the central nuclei of the cerebral hemispheres, from being at first mere points, then actually cover the corpora striata, after the manner in which they permanently incrust those bodies in the brain of the full-grown fish, so that we cannot avoid the conclusion, but are legitimately led to infer that the latter are the homologues of the former. Now, if this be conceded, the induction is irresistible as to the site of the organ of the perceptive consciousness in the cerebrum. For, wherever the hemispherical ganglia exist, the essential phenomena of the perceptive consciousness are manifested; and since it is admitted, and without a moment’s hesitation, by every experienced angler, that in the case of the fish we have clear and distinct evidence of the exercise of the perceptive faculty of memory and volition, *as opposed to mere consensual and instinctive action*, there can be no dispute that the thin laminæ of vesicular matter which incrust the corpora striata in the brain of the fish, are the organs of its perceptive consciousness. But in the human embryo it is equally clear and indisputable that these thin laminæ of vesicular matter are the primitive and basement convolutions of the hemispheres—the convolutions of the band—the ourlet of Foville, and ultimately *the great internal convolution* of the adult brain; so that if the former be really the homologues of the latter, the inference is most important and indisputable as to the seat of the perceptive consciousness in man. Moreover, one thing is abundantly manifest, that since these great internal convolutions are unquestionably the primitive basement convolutions of the hemispherical

ganglia, they must be the *portals to intellectual action*, where sensory impressions are translated into the form of intelligence, are perceived and idealized. It was here, I believe, that Gall located his organs of individuality; but since these convolutions are manifestly the portals to intellectual action, and as perception is but one and the first step above sensation, I think we are fully warranted in taking a more comprehensive view of their formation, and in considering them the organs of the perceptive consciousness,—the seat of *ideation, memory, and volition*. Now, of all the convolutions of the brain, they are the most symmetrical; they are the most constant and regular, and each exhibits with its fellow on the opposite side the most exact symmetry. Their connexions are multitudinous, and commensurate with their importance. Besides their relations with the sensory ganglia of special sensation, first and anteriorly they are in intimate connexion with those super-orbital convolutions of the anterior lobes, to which pathological investigations point as the organs through which we acquire a knowledge of the physical adjuncts of external existences, such as their size, shape, colour, number, weight, or resistance, &c.: secondly and laterally, they are connected with those primitive and early developed basilar convolutions surrounding the fissura Sylvii, which, from their connexion with the earliest of the animal senses, that of smell, appear to administer to the universal instinct of self-preservation: thirdly and posteriorly, they are in intimate union with those backwardly developed convolutions of the posterior lobes which belong more exclusively to the family of man: fourthly and superiorly, they are connected, through an order of anastomosing convolutions, with those great marginal convolutions which constitute the outer and most exalted boundaries of the hemispheres, and with those which take a longitudinal but tortuous course on the upper and outer surface of the brain, thus connecting, as it were, perception, the first step above sensation, with the loftier regions of thought.*

Now it is only in the human brain, that these basement convolutions of the hemispherical ganglia exist in the highest state of development. Compared with what we meet with in the brain of the monkey and other anthropomorphous animals, the

* “Of the internal convolution, or that of the corpus callosum, called by Foville, *convolution d'ourlet* (*processo cristato*—Rolando), the principal portion is above and parallel to the corpus callosum: in front it curves down parallel to the anterior reflector of the corpus callosum, as far as the locus perforatus, connecting it with some of the *anterior convolutions*. Behind it passes in a similar manner round the posterior reflection, connecting itself with some of the *posterior convolutions*, and in the *middle lobe* forming the hippocampus major, the anterior extremity of which is situate immediately behind the fissura Sylvii and locus perforatus. Its horizontal portion appears to be connected with some nearly *vertical* ones, which seem indeed to branch off from it. It forms, to use Foville's expression, a *hem* or

contrast is not more striking than it is psychologically significant. In man these complications and relations with the other primitive convolutions of the cerebrum are commensurate with their importance and with the vast and varied range of their function as psychical instruments. For while in the perception proper of outward existences, man stands on the same platform with the lower animals, and the process in him, as in them, is equally and alike intuitive, nature is not to him a mere system of *shapes*, *shades*, and *resistances*; but, by virtue of his highly attuned organization, "it speaks to him a higher language, embodies loftier ideas, and breathes into the soul diviner sentiments."

Perception has been aptly designated world-consciousness. For while in sensation the conscious mind is solely absorbed in its own subjective conditions or feelings, as induced by the bodily states, in perception its attention is transferred from *these* to their *interpretation*, as *expressive* of outwardly existing facts, and thus it implies a consciousness of the object which induced the sensation or impression,—a recognition of its cause, as a something external to the mind itself,—*an outward reality*. So that while sensation, on the one hand, is wholly subjective, in relation to knowledge, perception is, on the other, objective. In other words, the one is *self*, and the other is *world-consciousness*.

"But self-consciousness and world-consciousness are indissolubly connected. The one cannot exist without, but only by the other. Self is first perceived as that which is not *phenomenon*; the world is first perceived as that which is *not self*."*

But self-consciousness is the primary condition; for, as we have already seen,—

"The mind at first exists simply upon its sensational stage of development, and it only gradually, through the various impulses exerted by all the variety of subjective impressions, struggles out of *self*, and sees both *self* and *nature* in clear opposition. At first, however, it cannot interpret all these impressions in relation to its newly-acquired *world-consciousness*. This is the work of time and experience. Trace after trace has to be laid up in the mind, many of them to be compared together; the intuitions of one sense to be used in correction or elucidation of another; and thus gradually the *sign language* of sensation has to attain to the meaning which we attach to perception."†

selvage to the cortical layer of the cerebral hemispheres. The free margin of this convolution varies its character in different brains, according to the degree of tortuosity it exhibits, and the number of small fissures which are met with in it. The small folds which connect it with other convolutions on the inner surface of the hemisphere vary in number, and are generally found most numerous in the posterior part. Some of these folds are not distinctly visible unless the sulcus above it has been freely opened, as they are situated quite on its floor."—(Dr. Todd, on the Physiology of the Nervous System, "Cyclopædia of Anatomy and Physiology," p. 697.)

* Morell's "Psychology."

† Ibid.

All our perceptive experience is thus idealized from fragmentary impressions made upon the sensory organs,—the perceptive faculty idealizing the impression and converting it into an intellectual phenomenon, or knowledge. For no sooner has the perceptive consciousness been awakened, than a sight or sound which before produced an involuntary start, now excites a smile of recognition, the mind struggles out of self, beginning to throw itself into the objects around it, and to live in the world of outward realities. Mr. Morell has well observed,—

“Man is, at first, a mere creature of sensation and instinct; from that he rises to the power of perception, separating the world from himself, and becoming conscious, *here* of his own identity, *there* of the universe around him. After this, he attains to the power of representation and expression, stamps upon objects their distinctive names, classifies and generalizes them, and penetrates them with the light of the *understanding*. After this process of analysis, begins the still higher process of synthesis. The objects separated and classified, are now reconstructed in scientific order, and the truths which were first seen only by the light of sense and intuition, are now comprehended by the clearer light of *reason*. With the development of the *reason* are given the conditions for the development of the *will*, which rises, through like gradations, from mere instinct to conscious *self-action*, and, at last, to the height of *perfect freedom*.”*

* Morell's "Elements of Psychology," page 59.

CHAPTER III.

Unity of Consciousness.—Duality of the Brain, not incompatible with singleness of Mental Action.—Power of Volition on States of Consciousness.—Organs of the Perceptive Consciousness.—Phenomena, Ideation, Emotion and Volition.—Ideation in its relation to Man, as a Social, Moral, and Intellectual Being.

PSYCHOLOGY, the science which investigates the phenomena of consciousness, busies itself with the states, operations, and laws of mind. Now the human mind—"ILLUD, quod sentit, quod sapit, quod vult, quod viget,"—is "one and indivisible," for the unity of consciousness is the deepest and the most indisputable fact of our nature, and to feel, to perceive, to think, and to will, are, in truth, so many acts or states of mind. In other words, intelligence, emotion, and volition, are interwoven with each other, and are one at the root. We live in a succession of states, and the fact of the successive of ideas is indisputable. For although, as Sir Henry Holland has well observed, "mental science, from its nature, affords no exact measure of time,—the mind works in a succession of states. Two thoughts, or acts of memory, however closely related to one another, cannot be presumed to exist, at the same instant, in the consciousness,—each has its own individuality in time. Swiftmess of succession naturally suggests unity of time and state, which has no real existence. Nor can the mind maintain two impressions simultaneously; and though the succession be uniformly pleasurable or painful, still it is sequence, and not coalescence of effects. And thus the ever-changing relation of individual consciousness in the sentient unity, to the different bodily and mental actions, which form the totality of life, illustrates best, though it may not explain, the endless varieties and seeming anomalies of human existence."*

"There exists but one single principle," says Dr. Gall, "which sees, feels, tastes, hears, touches, thinks, and wills. But in order that this principle may become capable of perceiving light and sound, of feeling, tasting, touching, and of manifesting the different kinds of thought

* Vide Sir Henry Holland's "Chapters on Mental Physiology." Chap. iii., Mental Consciousness in relation to Time and Succession.

and propensity, it requires the aid of various material instruments, without which, the exercise of all these faculties would be impossible.”*

Still, however, the fact of the *duality* of the brain is not to be questioned. The brain is a double organ, and the symmetrical disposition of the parts of the encephalon on each side of the median plane must be admitted.

But, at the same time, this doubleness of the brain is in harmonious accordance with the doubleness of all the organs of sense; and, indeed, is just what *à priori* reasoning would lead us to expect as necessary to the functions of the special senses, as *double inlets* to knowledge. We have two cerebra, a right and a left brain, or hemisphere; the convolutions, or cerebral organs, are double, and the basement or fundamental ones of the cerebrum—the great internal convolutions, the *ourlet of Foville*—are perfectly symmetrical. The right brain corresponds exactly with the left, just as the right eye or ear corresponds with the left. But it by no means follows from this, as a necessary consequence, and as the late Dr. Wigan† has so laboured to prove, that the mind itself is *dual*—in other words, that consciousness is double; and that, because we have two brains, a right and a left brain, so have we *two minds*, each performing its own functions, but in perfect accordance so long as the two brains harmonize in quality, structure, and action with each other. All the information furnished to us by the senses tells of a mind “one and indivisible;” and in every instance in which there is a lateral doubling of the nervous centres, there we find a *commissural band*, like the corpus callosum, the office of which is manifestly that of a bond of union, associating the two sides of the cerebrum in one harmonious action. On this subject, Dr. Todd has well remarked:—

“I can no more infer the existence of two minds, from that of two brains, than I can assume a duality of our visual sense from the existence of two eyes. The two cases, indeed, are strictly analogous. The organic change on each retina develops a corresponding sensorial impression; and from the connexions which subsist between the retinæ, and still more from that between the centres of sensation, these impressions become *fused* into *one*. In like manner the organic change in the two brains developing nervous force, in similar modes and proportions, each being capable of affecting the mind similarly, although perhaps not identically, are yet so united in their action, that the double organic affection acts on the mind as *one*. But if, through default of the *connecting media* of the two brains, or through *lesion*

* “ur les Fonctions de Cerveau,” vol. i. p. 243.

† Vide “The Duality of the Mind proved by the Structure, Functions, and Diseases of the Brain, And by the Phenomena of Mental Derangement, and shown to be essential to moral responsibility.” By A. L. Wigan, M.D. London, 1844.

of either, the organic changes in each do not harmonize with those of its fellow, then it is plain that two separate and distinct mental affections will result, and that more or less of confusion must ensue. The confusion results from the *want of simultaneous affection of the same mind by two separate and distinct brains*. If, in vision, each centre of sensation affected only its own mental phenomena, as Dr. Wigan's theory would compel us to assume, then each mind would perceive a different perspective projection of the object presented to the eyes, and an elaborate and complex mental process would be required to combine the two sensorial impressions. How much simpler is the view of this process, which assigns the combination of the double impression to a physical union in the brain of each physical change in the retina,* so that, in truth, but *one impression*, different from each of its excitant ones, reaches the *mind*. So also in normal intellectual action, the organic changes of the two brains are united by the *various transverse commissures*,† so that but *one* physical stimulus affects the mind, and excites but *one* train of thought. Not so, however, when, from any defect in the brains themselves or in the commissures, the physical conditions necessary for the organic states of the two brains cannot be fulfilled.‡

Still, however, the work of Dr. Wigan "On the Duality of the Mind," is highly suggestive; and, if fairly interpreted by the physiological psychologist, is calculated to throw much light upon *alternating* states of consciousness, delusions, and irregular volitions, as well as upon other obscurities connected with the phenomena of mind.

Sir Henry Holland, in his valuable "Chapters on Mental Physiology," has an admirable essay On the Brain as a Double Organ, showing its compatibility, *as such*, with unity of consciousness. But unity of consciousness does exist, for who can gainsay it? and is therefore, of necessity, compatible with the conformation of the brain as a double organ, however we may argue in expla-

* Sir D. Brewster has shown that the fact that any near object makes two different perspective projections of itself upon the two retinæ was known so far back as 1613, to the Jesuit Aguilonius, who set himself to inquire how it is that the two dissimilar projections are blended into a *single unconfused image*, and came to the conclusion that it is not by reason of any optical conformity, but by a mental agency which he calls *common sense*. But to Professor Wheatstone belongs the exclusive honour of the *original idea*, and the practical demonstration of its correctness,—that it is on the mental combination of the two dissimilar projections made by a single solid object upon our two retinæ respectively, that our visual perception of its solidity depends; and to this *original idea* we owe his construction of the *Stereoscope*.

† An interesting case, in which the corpus callosum and fornix were imperfect, is published in vol. xxix. of the "Royal Medical and Chirurgical Transactions," by Mr. Paget, with some important remarks. It may be fairly inferred that the office of the corpus callosum is that of a band of union to the convoluted surfaces of the hemispheres of the brain, the medium through which the double organic changes in the double cerebral organs are made to correspond with the workings of a single mind.

‡ Dr. Todd's "Cyclopædia of Anatomy and Physiology," vol. iii.,—Physiology of the Nervous System, p. 723, b.

nation of the fact. Nay, more, does not this unity of consciousness, in perception, volition, memory, thought, and passion, constitute the sure and distinguishing characteristic of the sane and healthy mind? But there is another dynamical agency involved in the perceptive consciousness, *volition* or the *will*; and which, though limited in the sphere of its action to consciousness, is a mental element of paramount importance, for it has the power—varying, indeed, in degree in different individuals and at different times in the same individual—of *determining* and *controlling* the *succession* of our states, whether of thought or feeling. In the plenitude of its power it involves the highest attainments of which the human intellect is capable; and this power, be it remembered, of the mind, by the will, to regulate the succession of its states, whether those belonging to perception from *without*, or to thought and memory *within*, varying in different individuals and limited in all, *is given to us not merely to use, but to educate and exalt*. For, it has been well observed, “It is eminently capable of cultivation by steady intention of mind and habitual exercise; and thus, rightly exercised, it becomes one of the highest perfections of our moral and intellectual being. By no quality is one man better distinguished from another, ‘*than by the power of his will*,’ by the mastery acquired over the subject and course of his thoughts; by the power of discarding what is desultory, frivolous, or degrading; and of adhering singly and steadily to those objects which enlarge and invigorate the mind in their pursuit.”

“Magni est ingenii revocare mentem a sensibus, et cogitationem a consuetudine revocare.”—CICERO, *Tuscul. Quæst.**

And thus, while on the one hand the great and fundamental *mystery of life* consists in the relation of consciousness and volition to the functions of the special senses, and to those of the encephalic organs, which connect man as a sentient, percipient, and intelligent being, with his own organization and with the material world without, the importance, on the other hand, of the duty of sedulously cultivating that dynamical agency which has such a power in determining and controlling the *succession of our ideas*, cannot be overrated, for “the intellectual character of every mental process depends on the manner of succession, and especially on the action of the will in determining the result.”

• Now we have seen that *consciousness* with *volition* implies intelligence, and that, as antagonistic to mere consensual and instinctive feeling, it requires the instrumentality of the hemispherical ganglia for its manifestation. For, wherever the essen-

* Sir H. Holland, *Op. ante cit.*

tial phenomena are present which formularize the perceptive consciousness—namely, *ideation* and *volition*, with their associates, *memory* and *emotional sensibility*,—the agency and instrumentality of the hemispherical ganglia are involved; in other words, the organs of the perceptive consciousness, in the cerebrum, are in effective operation.

We have also seen there are valid reasons for the belief, and I have avowed my own conviction on the point, that the great internal convolutions—the *ourlet of Foville*, and essentially the basement convolutions of the cerebrum—are the central organs of the perceptive consciousness, the portals to intellectual action, where sensory impressions, the intuitions of the special senses, whether sights, sounds, tastes, smells, or feelings, become *idealized* and *registered*—that is, *perceived*, *remembered*, and *associated*; and where, too, the *ideation* of outward *individualities* is effected: for the senses are the inlets,—the media which connect us with the world without,—through them the perceptive consciousness is reached, and to their intuitions we owe our knowledge of the sensible qualities of external existences. In the perception proper, indeed, of mere outward objects, as in the intuitions of the special senses, man stands on the same platform with the other vertebrata, for the process in each and in all is the same. The lower animals, by virtue of their perceptive consciousness, not only perceive external objects, but remember actions and incidents associated with them. They shun danger after past experience, and act voluntarily. They have evidently an intuitive sense of time, space, form, and distance. And besides the animal propensities, they display social attachments, desires and aversions, angry passions and joyous feelings. But in them, it is obvious, *ideation* has reference, *instinctively*, either to the satisfaction of their appetites or to self-preservation. It cannot escape observation, that the *conservation* of the individual and the *multiplication* of the species are their dominating instincts; and that in the fulfilment of these, all the sagacity and laborious industry which they manifest are exerted. It may be, indeed, fairly inferred that the intuitions of the special senses, and their allied feelings, appetites, and instincts, form the chief and predominant part of the mental life of the inferior animals; but, at the same time, it must not be forgotten that these, too, constitute the inferior region of the true or conscious mind, and enter largely into the complicated web of human existence.

The instinctive attachment of the mother to her offspring, but limited in duration to the period of its helplessness, appears to be as great among some of the inferior tribes as it is among many of the human races. But this attachment, even among social animals, ceases with the period of infancy and helplessness; and

in their after life, those affections and endearing relations which are the charm of human life, have no existence. The attachment of the dog to his master is an enduring theme, but "it may be doubted whether we can find any instances of such feelings between animals themselves, excepting some cases of sexual unions. In general, they seem entirely destitute of sympathy with each other, indifferent in each other's sufferings or joys, and unmoved by the worst usage, or acutest pangs, of their fellows."* They are destitute of moral instincts.

The dog *knows* his master, and *remembers* scenes and actions in which they have been associated together. He may be said to have well-nigh all the rudiments of our perceptive knowledge—*ideation*, *emotion*, and *volition*; but he holds them in an instinctive form. He recognises his master by certain characteristics; but disguise those, and you balk his instinct. He is deficient in *reflective* as opposed to *immediate apprehension*, and of him it has been aptly said, "*Though he knows the person, he does not know how he knows.*" In the expressive language of Burns,

"Man is the god of the dog."

But man *perceives relations*, as well as external objects and their physical adjuncts. He notes events and circumstances in their *relations* to time and locality, or space. He is a *thinking* as well as a sensitive being, but every cogitative act necessarily implies an apprehension of the *relations* of the objects of *thought*. It involves a process of *comparison*, and the result is a *perception* of resemblance and difference. All knowledge, indeed, is a *relative* apprehension of things: and a *relation* cannot be rightly apprehended until we are equally familiar with both its terms, and until we can take our stand at either end and contemplate the other at will. And is it not this ability to shift the mental action, and to deal freely with the two sides of a *relation*, which constitutes the genuine mark of human intelligence, as distinguished from mere animal sagacity?

Now, in the perceptive consciousness of man with the great central organs, where *ideation* is effected, there are not only associated the super-orbital convolutions, through the instrumentality of which he acquires a knowledge of the physical adjuncts of natural objects, such as their size, form, colour, number, &c., but a still higher order of intellectual organs and faculties, by virtue of which he rises to the apprehension of the qualities and properties of external objects, and to a knowledge of their intimate structure and mutual relations, totally and altogether different from any intelligence that can take place in the case of the inferior animals. •

* Lawrence's Lectures on Physiology, Zoology, and the Natural History of Man.

In the emphatic language of Professor Sedgwick, "Man stands by himself, the despotic lord of the living world; not so great in organic strength as many of the despots that have gone before him in nature's chronicle, but raised far above them all, by a *higher development of brain*,—by a special instinct for combination,—by a prescience that tells him to act prospectively,—by a conscience that makes him amenable to law,—by conceptions that transcend the narrow limits of reason,—by hopes that have no full fruition here,—by an inborn capacity of rising from individual facts to the apprehension of general laws,—by a conception of a cause for all the phenomena of sense,—and by a consequent belief in a God of Nature."*

Still, however, the elements of all his knowledge—intellectual, moral, and religious—come through the perceptive consciousness; for they have their origin or source in intuitional or perceptive experience, in their respective cerebral organs, through the medium of the central organs of the perceptive consciousness, with which they are connected and associated. It is thus, through the perceptive consciousness, by the inlets of the special senses, that man gains his first glimpses of the *true*, the *beautiful*, and the *good*—of sublimity in nature, and of harmony in sound. For, as Mr. Morell has justly observed, "no one can doubt but that the creation around us has been formed according to the most perfect laws of form and beauty, or that the human mind is so constructed that the idea of beauty must, under the highest culture, correspond with the teachings of nature; so that the mere presentation of the beautiful *without*, is as well calculated to awaken the intuition of it *in the consciousness*, as our ordinary contact with natural objects awakens the perception of their physical qualities."†

Again, no sooner has the perceptive consciousness become developed, than man, long before he has attained to the utterance of articulate speech, is able intuitively to interpret the tones, gestures, and expressions of emotion, and becomes sympathetically affected by them. Nay, more, an intuitive apprehension of *right* and *wrong* is attached to certain actions, and evidently *precedes* in his mind any distinct comprehension of the language by which moral truths are conveyed. The blush upon the cheek, and the early sense of shame, come before there has been any trains of thought as to the consequences of crime or misconduct. In the expressive language of Lord Bacon—"The light of nature not only shines upon the human mind through the medium of the *rational faculty*, but, by an *internal*

* Sedgwick's Discourse on the Studies of the University of Cambridge. Fifth edition. Preliminary Dissertation.

† Morell's Psychology.

instinct, according to the law of conscience, which is a sparkle of the purity of man's first estate."

So, again, "closely connected with the *moral*, are the *religious* intuitions of the soul. These are developed more or less distinctly amongst the earliest of our human sentiments, in the form of *awe*, *veneration*, and *reverence*, which are inspired by objects of sublimity, grandeur, vastness, and mystery. In process of time, other elements—first the mental, then the moral—are joined, to the primary intuition, until at length we reach the elevation of an intelligent, voluntary, and cheerful dependence upon an Infinite and All-perfect Being."*

And thus we see that the original sources or germs of the elements of all his knowledge lie within the region of immediate experience in the perceptive consciousness. All knowledge consists in the perception of truth, and "*truth in the agreement of the sign with the thing signified*;"† and hence it follows that the elements of knowledge are so many and as different as are the various fundamental truths, intellectual, moral, and religious, which they embody. But in all our psychological investigations we must never lose sight of the important fact, that the human mind, from its earliest existence, comprehends *implicitly*, and that, too, in the very nature of its existence, *everything* which its interior nature is calculated afterwards to develop. These germs, or essential elements, as constituent endowments, exist in every *mens sana*, *implicitly*, from its earliest existence, and they are one and all evolved *explicitly* through the perceptive or intuitive consciousness.

True it is, that by no training or culture can we create a new faculty, any more than we can invent a new law of nature, or give a new organ of sense. But, nevertheless, it is equally true that the germs (so to speak) of all our mental activities, intellectual, moral, and religious, *are present from the first*, and they are all evolved through the perceptive consciousness, with the collateral development of the vesicular matter of the cerebral organs, through which they are manifested throughout the totality of life; at first, in merely an instinctive and impulsive manner, and in the order and succession in which each specific form of mental activity is roused into prominent and effective operation, *by virtue of its reaction with the external world or nature*. To Mr. George Combe‡ belongs the honour of having first clearly demonstrated that the harmony which exists between the constitution of external nature and the mental constitution of man, is an all-pervading principle of creation, and a perfect

* Morell's *Psychology*.

† Dr. Wollaston's Definition of Truth.

‡ Vide The Constitution of Man, considered in relation to External Objects, by George Combe.

and beautifully symmetrical system; and by bringing into one point of view the different constituent elements of the human constitution, and showing their relations to each other and to external nature, he has thrown a flood of light upon the phenomena of human life, and has indisputably established the fact, that the world, throughout its constitution, is framed in admirable adaptation to the faculties of man, as an intelligent, a moral, and a religious being.

We have seen that the mind, like the body, passes through its phases of development, and that at birth man is the mere creature of sensation and instinct; for in the earliest stage of his psychological progress, the *intelligence* is purely sensational, the *feelings* simply those of pleasure and pain, and the *impulses to action* innate and instinctive. The senses, indeed, come into play from the moment of birth; for as the human infant nestles in its mother's bosom, *smell* is its guiding *sense*, and it is through *taste* that it satisfies its first instinctive want or craving. But from this state of isolation and subjective feeling, in which the mind may be said to be virtually passive, it gradually rises to the higher phase of development which we are now considering, of intuitional or perceptive consciousness,—a state of increasing activity, in which a degree of mental attention is necessarily evoked, and where the idealized impressions are retained in the memory, as *representative ideas*, with a measure of tenacity commensurate with the attention bestowed. For no sooner does the perceptive consciousness begin to dawn, than in the child's mind the image of its mother becomes associated with its idealized impressions of smell and taste; so that at the sight of her its little heart bounds with pleasure, and its joyous emotions are as evident to all, as its loudly-proclaimed disappointment makes itself understood when denied the gratification which its instinctive and inherent feelings crave.

When we view man, indeed, in his threefold capacity of a social, a moral, and an intellectual being,—and, accordingly, as endowed with intellectual faculties, with propensities and affections individual and social, and with moral and religious feelings and sentiments,—we cannot avoid the conclusion that *ideation is the first step in his intellectual progress*, nor that he is admirably fitted in all his capacities for the natural world without, and for the social conditions in which his Creator has placed him. *Ideas are the pabula of thought*, and form equally a constituent element in the *composite nature* of our animal propensities, and of our emotional and moral feelings.

Ideation is as essential to the very existence of memory, as memory is to the operations of thought. For what, in reality, is memory, but the fact of *retained idealized impressions* in the

mind? And without these retained idealizations, embodied in the memory as *representative ideas*, where are the materials of thought, and how are the processes of thought to be effected? True it is, that the agency of volition is alike essential to memory; for unless the attention of consciousness, by an act of volition, be arrested, or directed and fixed upon the object, the *idealized impression* may be so evanescent and transitory, that, "like the baseless fabric of a vision," it may leave not a trace behind it.

I have advanced the opinion, that the basement convolutions of the cerebrum—the *great internal*, as the portals of intellectual action, are the central organs of the perceptive consciousness where *ideation* is affected. And we have noted the fact, it is only in man that they exist in their highest state of development, and that their connexions with the primitive convolutions in the anterior, middle, and posterior lobes of the brain are so multitudinous; commensurate, in my opinion, with the psychological importance of their office, as the central organs through which the other perceptive organs, intellectual, moral, and religious, are reached and associated.

The development and relations of these basement convolutions are in accordance with the extent and range of the perceptive faculties of the animal, and may be fairly taken as a criterion or measure in fixing its place in the scale of being. The true difference between man and the inferior animals rests specifically and fundamentally on the *greater number* and *higher nature* of his psychological endowments. They have many cerebral organs in common; but there are others which he possesses, of which they are altogether destitute; and this constitutes the immutable distinction between him and them. We know that it is only the anterior lobes of the brain which exist in fishes, birds, and reptiles, and that the middle lobes do not make their appearance until we ascend to the mammalian class. And hence how limited in number are the cerebral organs and psychological endowments of these animals, when compared with those of man; and hence, too, the important induction, that the psychical faculties which they do possess and manifest are attributes of—for they must have their material organs, their local habitation and abode, in—the *anterior lobes* of the brain. Now, all these animals, besides their dominating instincts of *self-preservation* and of *reproduction*, have, in common with man, the sensory ganglia and organs of the special senses, the internal or basement convolutions, though necessarily limited to the anterior lobes, some of the super-orbital and other convolutions at the basis of the brain, with a rudimentary and varying degree of anterior development. But they are alike

destitute of that frontal, towering, and expanded development, and of those exalted intellectual endowments which are the *sole prerogatives of man*. They all more or less manifest the essential phenomena of the perceptive consciousness, ideation and its associates, memory and volition, emotional impulses and feelings, and, amongst the highest of the order, some traces of ratiocination. The melodious notes of the sylvan songsters attest indisputably their possession of the *organ of tune*, in common with man; the varying strains of the mocking bird and the articulatory exhibitions of the parrot, are equally conclusive of the presence of the *imitative faculty*, while the building of their nests speaks for the *constructive instinct* of the tribe. They have all an intuitive perception of external individualities, and of some of their physical adjuncts. In the mere perception, indeed, of external objects by sight, and in that of some of their sensible qualities by touch, or feeling, smell, and taste, man, standing on the same platform, is inferior to some of the lower creation. He has neither the far-seeing eye of the eagle, nor scent-smell, of the dog; but in the apprehension of the intimate structure and chemical composition of substances, of their properties and mutual relations, as well as of the adjuncts of physical objects—as of space, form, size, weight, colour, number, and order—how immeasurably he rises above their level, by virtue of the greater development and higher endowment of the cerebral organs which they have in common in the anterior lobes, and of others in the same lobes, which he possesses, but of which they are altogether destitute. Thus the dog, looking at an open printed book, sees the book itself, as an external object, just as clearly and as plainly as his master does, but he has no apprehension, nor can he be made to apprehend the things therein signified by the printed symbols. To him they are dead letters without meaning. His intuitive perception of individualities—his knowing his master, and perceiving the book, and his power of distinguishing between persons and objects, confer upon him the capability of a narrow education; while in man, with his intellectual endowments, the ideation of individual existences “yields that insatiable curiosity, that restless thirst for universal knowledge, which exhausts the mineral, vegetable, and animal kingdoms, imbibes all the information this diversified globe can supply, and impels him to scale the heavens, and take note of the wonders of the starry infinite.”*

So again, in reference to the adjuncts of external existences, the organs of form, size, weight, and colour, in association with the central organs of the perceptive consciousness, “enable the

* Memoirs of Dr. Spurzheim, by A. Carmichael, M.R.S.A.

inferior animals to distinguish individuals, and to know familiar objects from strange, to preserve their own equilibrium, to take pleasure in each other's striped and spotted skins, or splendid plumage; but in man, these perceptive powers stimulate to new creations. The impulse of form, aided by still higher faculties, shapes the marble into beauty, and almost inspires it with life,—that of colour, under the guiding hand of genius, flashes its creations upon the canvas, and brings back to our admiring eyes, in all their living energy, from times long past, floods of heroic adventure, or the hallowed displays of divine benevolence.”*

So, too, in his perception of the changes in external objects, of the phenomena of action, of *events* and their adjuncts, *time* and *place*, how immeasurably is he raised above them,—comprehending in its fulness the revolutions of the earth itself, before history had a name, and the history of his own species in every portion of the globe. In fine, through the instrumentality of those exalted intellectual endowments peculiar to man, and which have their acknowledged seat in the anterior lobes, “adorning his brow like a diadem,” the faculties of calculation, of order or arrangement, of comparison and causality, of ideality and wonder, he can number the stars, and with instruments furnished by the higher mathematics, can weigh and measure the planets, assign their courses and times, mark out the path and anticipate the coming of comets, calculate the distance of the most distant nebula, and only terminate his investigations in the inaccessible depths of infinitude. He arranges every object that comes within his cognizance, whether material or mental. He perceives resemblances and differences, abstracts and generalises, analyses and combines, compares and infers, and “ascends from nature up to nature’s God.” From *ideality*—the imaginative faculty, the vivifying soul of music, poetry, and eloquence, refining, exalting, and dignifying every object susceptible of improvement—springs his sense of the *beautiful*; and from *wonder*, that of the *sublime*.

But reverting to the animal and moral nature of man, the fact is equally manifest, that ideas form a constituent element in the composite nature of the animal propensities, and of our emotional and moral feelings. Dr. Carpenter has clearly

* *Colour Blindness*.—At a post-mortem examination of Dr. Dalton, Mr. Bally (formerly assistant to Dr. Spurzheim) pointed out an imperfect or deficient development of the convolution of the anterior lobes, the site of the organ of colour. “Here, then,” says Dr. Wilson, “according to the judgment of those present, there appeared a marked deficiency in that portion of the brain which phrenologists regard as the organ of colour, in the person of the most famous example of colour-blindness; and though he were not famous, his case would deserve record, as the solitary one where the brain itself was examined.”

Researches on Colour-Blindness, by Dr. George Wilson, F.R.S.E., page 106. 1856.

pointed out the distinction between propensity and instinct, and has shown that in the former, *ideation* is involved. "Instinct," says he, in his able analysis, "is an expression for a certain series of phenomena directed towards a given purpose, but not really involving any other physiological or psychological actions than sensations and respondent movements; whilst *propensity* is a desire for gratification, involving an idea of the object."

Among the personal affections of the Ego, the love of life is paramount, and around it are marshalled and associated those instinctive and inherent activities, or animal propensities, subservient to the defence and conservation of existence.

The instinct of *self-preservation* is an universal instinct, and the very first that is roused into action. To it all the special senses are necessarily and of course subservient; but first and foremost are those of smell and taste. It is the sense of smell which attracts and guides the human infant to the mammary gland of its mother, to satisfy an *internal want or craving*. Hunger and thirst, as instinctive and internal cravings or feelings, are implanted by the Author of nature, to use the words of Prochaska, in accordance with the "*lex nostri conservatio*;" and, as subjective sensations, they have their immediate seat in the vesicular nervous tissue of the stomach and mouth.

But the *propensity for food*—and in hunger we have both *appetite* and *desire*—involves for its gratification both *sensorial* and *psychical* agency. We all know by experience how a savoury odour will cause the mouth to water; but is it not equally true that the very thought of it, the mere recollection or recalling of the idealized sensation, will produce the same effect? To ensure the gratification of the propensity, and to satisfy the desire for food, befitting means and modes are to be devised and adopted; and these as assuredly involve and necessitate the agency of *ideas*, and in their execution, in the adaptation of means to ends, the active exercise of intellectual faculties.

We have seen that, in subserviency to the instinct of self-preservation, the sense of smell is *primordial*; and it is interesting to follow up the cerebral connexions of the olfactory ganglia, and to note that the peduncles are not only in commissural connexion with the great centres of sensorial feeling, the *thalami optici*, and with the *ourlet of Foville*, where the sense is *idealized* and *registered*, but with those primitive and basilar convolutions of the cerebrum which surround the fissura Sylvii, and are coeval in point of existence with the fissure itself.

"Each ganglion of the olfactory nerves is connected with the hemispheres by a long, narrow *commissure*, lodged in a triangular groove, and passing backwards, till opposite the *fissura*, where it splits into three divisions; the most external of

these, distinctly medullary, runs down the *fissura Sylvii*, to be connected with the *anterior extremity* of the *middle lobe*; the internal is connected to the *posterior internal surface* of the under part of the *anterior lobe*; and the middle, which is the shortest, and, strictly speaking, no more than the internal portion of the external, is connected with the *posterior edge* of the *anterior lobe*.* And thus by the earliest and guiding sense to the instinct of self-preservation, from its cerebral connexions in the encephalon, are we not also guided and led in our psychological researches to the *allocation* or seat of the psychical organ in hemispheres of the *alimentative propensity* in man?

Closely associated and interwoven with the *love of life*, and besides those immediately subservient and required for the mere support and conservation of existence, there are other active and definite animal propensities common to man and the lower animals. There is the instinct of *self-defence*,—the *combative propensity*,† for the protection of life; and the *destructive*, to provide for its sustenance; there is that of *cunning* or *secreteness*, to lie in wait for the prey, or to elude the pursuer; that of *fear* or *cautiousness*, to shrink back from the encounter; and that of *courage* or *firmness*, to face it openly. There is the *propensity to hoard food* for future use, and the *constructive ability* to provide for it a storehouse.

Again, besides these, there are the higher instinctive activities—the love of self, or *self-esteem*—the love of others, or *benevolence*—and the love of approbation; but these, although not exclusively human, are only found among the higher order of social animals. Now, to be satisfied that these are *primitive, distinct, and inherent* animal activities, all involving *ideation*, and roused into activity and exercise through the perceptive con-

* Solly On the Brain, p. 286, 2nd Edition.

Dr. Andrew Combe has recorded an interesting case in which the *love of life* was a ruling passion of a lady upwards of sixty years of age, and in whom there was found, at the *post-mortem* examination of the brain, "an enormous development of one of the convolutions at the base of the middle lobe, so striking as to arrest instant attention. The corresponding part of the skull," says Dr. Combe, "showed a deep and extensively-moulded cavity or lid, running longitudinally, with high and prominent sides, and presenting altogether an appearance much more striking than in any skull I ever saw. Whether it may have any connexion with the love of life, is a circumstance which may be determined by future observations."—*Phrenological Journal*, vol. ii.

† Mr. Combe was present at the *post-mortem* examination of an old gentleman, who had long been remarkable for the mildness of his disposition and the courtesy of his manners, until suddenly, about four years before his death, he became irritable and violent in his temper. From being kind, gentle, and civil to his servants, he became irritable, excitable, and passionate. "In the left posterior lobe of the brain a cavity was found, two inches in length, lined with a yellowish membrane, into which blood had been effused and afterwards absorbed. Its centre was on combativeness, but it extended also into adhesiveness, and a small portion into philoprogenitiveness. The corresponding portions of the brain on the opposite side were sound."—*Combe's System of Phrenology*, 5th Edition, 1853, p. 252.

sciousness, we have only to appeal to nature. And the allocation of the cerebral organs of these activities by Gall and Spurzheim in certain primitive convolutions of the cerebrum at the base, surrounding the *fissura Sylvii*, and at the sides and upon the hemispheres, is not without the support of pathological evidence. And it is, if I am not greatly mistaken, to *post-mortem* examinations of the brain, and to pathological investigation, more than to any other source, that we are to look, not for the discovery of normal functions, but for evidence in support or refutation of the dogmata advanced by craniological observers. Such is the course I have kept steadily in view, and pursued with great interest, and not without advantage, in my limited field of observation.*

Throughout the whole creation, next in importance to the *love of life*,—the *instinct of self-preservation*, is that of *generation*. These are the two dominating instincts in nature. Locating, as I do, with Serres, the sensory ganglion of the sexual instinct in the median lobe of the cerebellum, as the result of personal observation and pathological research, it is highly interesting and instructive, in consequence of the direct commissural connexions of this sensory ganglion with the centres of emotional feeling, and through them with those of intellectual action, to trace the development of the composite character of the amative propensity in man, and to note how the instinct of propagation—one of absolute necessity—becomes a principle in our moral constitution, connected and associated with all our moral responsibilities, whilst, “at the same time, it furnishes materials for the imagination, taste, and perception of beauty.” But in man, with the amative propensity, is inseparably associated and interwoven that of the *love of offspring*, of the *family circle*, and of *home*, knitting together in the bonds of affection,

* In a case of tubercle of the brain, in a child, where the deposit was upon the superficies of the hemispherical ganglia, the psychological phenomena were most significant, and the sole indication of the local seat of the disease. At the *post-mortem* examination of the brain, the tubercular deposit was found to be situated on that part of each of the hemispheres of the brain where Gall and Spurzheim have located the *organ of firmness*. For some time previous to his illness, the parents of the child had been forcibly struck with a change in the disposition of the child, which they had observed for some time to be gradually taking place. From being a happy, placid, and docile boy, he had become more and more petulant, self-willed, and obstinate, very determined to have whatever he set his mind upon, and not to be driven from his purpose; in a word, he had become a most obstinate and self-willed boy. So marked, indeed, was the change of disposition, that it had become a subject of serious consideration with them, whether it was to be attributed to some latent disease under which he might be labouring, or to mere infirmity of temper. But as he continued to eat, drink, and sleep well, and did not appear to be suffering from any bodily complaint, they contented themselves with endeavouring to correct by moral management and discipline, what they were inclined to consider rather an infirmity of the mind, than of the body. I brought the case under the notice of the Royal Medico-Chirurgical Society. It was read, June 14, 1842, and published in vol. xxv. of the Society's Transactions.

husband and wife, brother and sister, friend and friend. For, in accordance with high behest—"Be fruitful and multiply, and replenish the earth," the social affections bind family to family, and nation to nation, in one bond of universal brotherhood. Man is a social being, and the *love of society* or *propensity to associate* is inherent and instinctive. But among the lower animals, as I have already observed, the attachment of the mother to her offspring, however great for the time, is limited to the period of its infancy and helplessness; between them, in after life no endearing relations are observed to subsist. Now, why is this? Clearly and obviously because they do not possess, but are actually destitute of, the organs and faculties which administer to such relations.

For, of the posterior lobes of the brain, among the inferior animals we do not meet with the least vestige until we ascend to the carnivorous group. In the fulness of their development, these lobes essentially belong to the family of man, and are the great centres and seat of the psychical organs of his social propensities and attachments, and of the human affections.* Among monkeys and other anthropomorphous animals, there is a considerable development of the posterior lobes; and these animals are especially distinguished for attachment to their young, and for their social propensities; but, in them, they do not cover and overlap the cerebellum, as in man. Their great elongation backwards, and full development in the human brain, have led Professor Retzius to divide the whole family of man into *dolichocephalæ* and *brachycephalæ* in proportion to their breadth; and this division is not without psychological import among the races of man. Closely allied with the social propensities and human affections are the emotional states, and in them ideation is equally involved; for, alike in the composite nature of each and of all, there is present an *intellectual element*, as well as *sensorial feeling*. Emotional is essentially different from common sensibility. We cannot identify hopes and fears, joys and sorrows, with the simple elementary feelings of pleasure and pain. The emotional differs from the sensational consciousness: they are distinct mental states. Still, the simple, elementary emotional sensibi-

* Mr. Combe mentions the case of a gentleman who died in Edinburgh, in whose brain "there were found at the *post-mortem* examination twenty-seven abscesses, of which eleven were in the cerebellum, and ten or eleven in the posterior lobes. There was only one in the anterior lobe devoted to intellect, and one was situated in the organ of tune, on the left side. He had made his will two days before his death, and to his physicians, his mind seemed to be entire. His brother, however, assigned as the reason why he desired the brain to be examined, that he had observed, that before his death, the deceased had manifested an almost *total loss of affection* for his wife and children, to whom, when in health, he had been tenderly attached. The coincidence between the seat of the disease, and the decay of the domestic affections is striking."—*Combe's System of Phrenology. Ante cit.*, p. 243.

lities and impulses, like the instinctive feelings, are strictly consensual, and have their seat in the sensory ganglia; and as automatic functions of independent nervous centres, they may be brought into play through purely sensational channels, without the agency of volition or thought. Thus, laughter—the *expression of joyous emotion*—when excited by titillation on the surface of the body, is simply and strictly a *consensual act*, as much so as the smile that mantles on the infant's countenance from the effects of flatus or some internal excitation. But the true emotional feeling involves ideation; and such is Laughter, “holding both her sides,” when provoked by the presence of ludicrous ideas in the mind. In the one case, the physical impulse upon the surface passes *upwards* to the thalami optici; in the other, the ludicrous ideas are transmitted *downwards* from the centre of intellectual action in the cerebrum to them; and alike in both the motor impulses are instantly evoked, and the expression of the joyous emotion elicited. These facts were strikingly exemplified in the young woman's case to which I have more than once alluded; for at the time when her mental faculties were completely benumbed or paralyzed, and the only avenues open to emotional sensibility were those of sight and touch, through either of these channels feelings of fear and alarm, of terror and fright, could be instantly excited, with convulsive shuddering. And again, when she had so far recovered the power of ideation and observation as to perceive that her lover was faithless and paying attention to another, her emotional sensibility received a shock in another direction. She was *wounded in her affections*; jealousy was aroused; and the catastrophe followed, which, fortunately for her, proved salutary.

And thus we see that the two great centres of emotional feeling in the encephalon—the thalami optici and corpora quadrigemina, placed midway between the cerebrum and the external organs of sense, may be played upon and roused into action through either, from below or from above; *upwards*, from the *outer world*, by the appropriate stimulus upon the nervous vesicular expansion of each of the external organs of sense; *downwards*, from the cerebrum, from the *inner* or *psychical world*, by the flow of our thoughts, and the workings of ideo-dynamical, emotional, and moral agencies in our cerebral organs.

But the elementary emotional feelings and motor impulses, excited into action by impressions from without, bear the same relation, in the absence of the psychical element, to the true emotions, which the instincts do to the propensities.*

* It is greatly to be regretted that *perversions* of the *emotional feelings* should have met with such little attention in pathological researches.

Ideation is the connecting link—intermediating between the two extremes of mental action, emotion, and volition—between the inherent elementary emotional sensibilities on the one hand, and the operations of thought and volitional power on the other. As an intermediating and connecting link between emotion and volition, it is sometimes in subordination to the one, and sometimes to the other.* This is a point needing no illustration; but

* "During the past year, an interesting *post-mortem* examination came under my observation. It was the case of a little girl, aged eight years, who died on the eighth day of the attack, from effusion at the base of the brain, with softening of the pons Varolii. The manner of her death was very characteristic of the local lesion; but the point of present interest was her impulse and emotional character while living. It was the theme of remark, and a matter of common observation, to all who knew her. I have never met with a more impulsive, excitable, curious, old-fashioned, and shrewd little girl, in the course of my life. I have watched her progress from infancy. She had a large head, and fully-developed convulsions; but the size of the thalami optici was such as to rivet my attention, from their unusual magnitude and healthy appearance. I hope others will bear the comparative development of the thalami in remembrance in all cases where the impulse to emotional excitement has been characteristically great. Attention to this point is important, since it is only from multiplied observations that a safe and sound induction can be made."—*Physiological Psychology*, p. 68.

A striking instance of the dominant power of emotional apprehension—the *sheer dread of bodily pain*, in upsetting the balance of the mind, in the case of an intelligent, but highly impulsive and excitable lady, came under my notice in the summer of 1848. From that time, until within eighteen months of her death, which took place at Hornsey in the autumn of last year, she was under my observation. I was not apprized of her death until after she had been interred, which I sincerely regret, for no *post-mortem* examination was made, and there was an interest attaching to her case, in my mind, which nothing short of a knowledge of the pathological condition of the brain could satisfy; and besides which, it was her own often-expressed wish to myself, to have her head examined after her death.

She was the daughter of a man of some public and political notoriety in his day,¹ and was begotten and born in the midst of a stormy period of her father's life. Between the ages of her parents there was considerable disparity. Her father was many years the older of the two; and during the period of utero-gestation, her mother was the subject of great alarms and troubles, and underwent much anxiety and mental agitation. I mention these circumstances, because I think, with Dr. Latham, that, "prior to diseases, their diagnosis, their history, and their treatment—prior to them and beyond them, there lies a large field for medical observation. It is not enough to begin with the beginning. There are things earlier than their beginning, which deserve to be known. The habits, the necessities, the misfortunes, the vices of men in society, contain materials for the inquiry and for the statistical, systematizing study of the physician, fuller, far fuller, of promise for good to mankind, than pathology itself."²

When first called upon to see this lady, she was some months advanced in pregnancy with her second child, and I soon found that the parturient state was the source of great mental uneasiness and discomfort to her. In consequence of the bodily pain and suffering which she had undergone at her first accouchement, she was looking forward to the next with fear and apprehension. So deeply, indeed, was the recollection of the first impressed upon her mind, that no sooner was she sensible that she had again conceived, than she became despondent and full of fear; nor could she bear the sight of the gentleman who had attended her in her confinement. His presence, associated as it was in her mind with her former suffering, made her quite miserable. It was in vain that I attempted to reason away her fears; they seemed to increase upon her as gestation advanced. The fear of bodily pain in prospect, the physical pains of labour, marred her present comfort, and ren-

¹ Samson Perry, of the *Morning Chronicle*.

² Dr. Latham, *On Diseases of the Heart*.

hension of his emotional nature is acquired, which enables them at once and without hesitation to recognise its manifestations.

knowledge of her child's birth until after it had been washed and dressed, when it was presented to her by the nurse. She seemed pleased that her trouble was over, but at first she could scarcely believe the fact. For the first two or three days, everything seemed to be going on satisfactorily; she was composed and quiet, and it was vainly hoped she would regain a healthy tone of mind, as she had done before. The event proved otherwise, for soon the *fear* of death took possession of her. The slightest bodily pain, any griping of the bowels from the effects of aperient medicine, or spasm from flatulency, produced a paroxysm of despondency and fear.

She lost all self-control. She took no heed or interest in her child. At first, for a few times, she attempted to nurse it; but the pain of suckling she either could not or would not endure. She said, the pain of nursing would be her death. It was in vain to attempt to reason with her on the groundless character of her fears and apprehensions. She did not appear to fear death in connexion with her own state in the world to come; but what she dreaded was, the *pain*, the *agony* of the act of dying. I had consultations on her case with Dr. Locock and Dr. H. Mouro, and it was found necessary to have a female attendant from an asylum to be with her. At times she was violent, under excitement; but as she was easily controlled, private surveillance sufficed, and she was never removed from the care of her friends. From the connexion of her malady with the puerperal state, hopes were entertained, which were never realized, that ultimately she might regain a healthy tone of mind. She returned to her family at Hornsey, but neither mentally nor bodily was she ever again able to discharge the relative duties of life.

From this time I lost sight of her; but she was an invalid for the remainder of her life—the victim of illusory illness and despondent feelings. "For the last three months of her life," writes Mr. Hands, of Hornsey, her medical attendant, in a letter which I received from him after her death, "I had to sustain a sinking and enfeebled frame. She was exhausted to the last degree; I never saw a frame so denuded of muscular and adipose substance. Life was sustained for several weeks on the smallest possible quantities of food. Her perceptions to the last hour of her existence were acute, and she often said she could not die, and seemed to think that the ordinary course of nature in her case would be reversed." But, "*Lex non pœna, perire*;" although with her it was the dread of the *pain* of the *agony* of dying which poisoned the cup of life. How interesting and how instructive in her case it would have been to have known the pathological condition of the thalami optici, where the association of bodily pain with emotional despondency, was so prominently though painfully exemplified!

I have at this time a lady under my care, with whom any emotional excitement is attended with the loss of the memory of words, and even of the names of common things. Her case is not without interest. She is about fifty years of age, the mother of a large family, and of an impulsive disposition. In June, 1855, the unexpected failure of the bank of Messrs. Strahan, Paul, and Co., in the Strand, where her husband usually had a very considerable balance of money, was suddenly told to her, and under circumstances which gave her nervous system a shock. Seeing her husband perplexed and annoyed, if not distressed, she bore up at the time, and suppressed the expression of her feelings; but the next day, when walking out with her daughter, at the corner of a street they suddenly encountered a nobleman's carriage, as it was driving rapidly past them, and she instantly exclaimed, "*There goes the villain who has ruined and reduced us to beggary!*" She was then seized with a sudden giddiness, and all but fainted; immediately afterwards she began to talk quite incoherently, and it was not without difficulty that she was got home, when I was immediately sent for. It was some hours after the seizure before I was able to see her. She then said she "*was better, far better*;" but her mind was astray. She was evidently under fear and alarm, and did not understand what was said to her, or comprehend any question that I put to her, excepting the assurance that she was better. This assurance seemed to give her great satisfaction for the moment, but it was always followed by her saying, "Are you sure? Oh yes! I am better, much better,—but are you quite sure? Thank God!" &c. Her pulses

But in man's moral and religious attributes the inferior animals do not participate. These are exclusively *his sole prerogatives*, constituting an immutable distinction between him and the whole brute creation, but, equally with his social propensities and the true emotions, involving *ideation* in their manifestation and progressive development. The moral instincts of right and wrong, and the emotional feelings of awe and reverence, come before all teaching, and are aroused in their respective organs through the perceptive consciousness; but intellectual agency is needed for him to apprehend and understand the *basis upon which moral obligation rests*, and to constitute "*religion a reasonable service*." The essence of his responsibility to God and his fellow-man has its foundation in the basis of his intellectual, moral, and religious nature.

Now, the transverse convolutions upon the upper surface of the cerebrum are *exclusively human*, for they are only to be found in the family of man; and the allocation, therefore, in these convolutions is no unreasonable procedure of the organs of those exalted moral and religious attributes or faculties which man *alone possesses*, and which raise him so high in the scale of being above the whole brute creation.

It was here that Gall and Spurzheim located the organs of the *moral sense*, or *conscience*, of *reverence* or *veneration*, of *awe* or *wonder*, and of *hope*, "which springs eternal in the human breast." And the allocation, founded as it was on an accordance of the external configuration of the cranium with observed

was small, feeble, and irregular; the surface of body generally cold and clammy, and the forehead rather hot, but there was no complaint of pain in the head. An abiding sense of apprehension and depression of mind was a prominent symptom. On the following day, the pulse was more steady, regular, and had acquired more volume; but the face was rather flushed, and the forehead hot. An antiphlogistic mode of treatment, without depletion, was strictly pursued, under which she gradually improved. Her perceptive and thinking powers were soon regained. She knew where she was, and all the family about her, as well as myself; but the memory of words was for some time in abeyance. She could not recollect the name of any one, not even that of her own daughter, who was constantly with her—nor of the most familiar things in the house by which she was surrounded, as a chair, table, looking-glass, &c. She had a perfect recollection of past circumstances and events up to the time of her seizure,—understood anything that was said and done about her—felt deeply conscious of her own inability to recollect names and common words when talking—and at times such was her emotional sensibility in consequence, that she became annoyed and excited even to tears. In this case, it may be fairly inferred that the sudden shock to the nervous system in the first instance deranged the organic actions and normal co-relations of the emotional and intellectual centres. The giddiness and faintness consequent upon the *sudden outburst of emotional excitement* in the street, and indicative of disturbance in the balance of the circulation in the brain, was followed by delirium, and incoherent rambling as a consequence. The delirium was of short continuance, coherence of mind was soon regained, and the powers of thinking and reasoning were gradually though slowly restored; but there long remained, and there still exists up to this time, a manifest *dislocation* of the memory of words, to use an expressive term of Sir H. Holland, on the slightest emotional excitement or mental agitation.

mental manifestations, rests precisely on the same kind of evidence, on the same basis, as that which assigns to the high, towering, and expanded forehead *the organs of intellectual greatness*. I do not hesitate to avow my conviction, though my field of observation has been limited, that, so far as *outward and visible signs* can be taken as indices of the mental energy and power *within*, Gall, Spurzheim, and Combe have furnished the data and fixed the landmarks. It must be acknowledged that no one has studied the varying forms of the human cranium, with a view to their psychical significance, with so much care and attention, and on so extended a scale, as the illustrious Gall; for it was the labour of his life, and he was the founder of Physiological Phrenology.

The cranioscopic observations of subsequent observers, including Carus among the most recent, have all tended to establish the general positions of Gall. The fact, indeed, is indisputable, that the development of the cerebrum moulds and fashions, giving configuration, shape, and volume, with some well understood limitations, to its bony envelope—the skull, so that *cranioscopacy*, is, in truth, an appeal to observation and to nature.

CHAPTER IV.

Intellectual Consciousness.—Articulate Speech, the Exclusive Prerogative of Man.—Language, common to all the Races of Men.—Cerebral Seat of the Organ of Speech, in the Anterior Lobes of the Brain.—Language, as the Instrument of Thought and Reasoning.—The Understanding Defined.

Intellectual Consciousness.—"A scientific psychology," says Waitz, "should exhibit the laws according to which the life of the human mind is evolved; that is, it should point out the common basis upon which *all mental life* rests, follow the threads by means of which all its phenomena are connected with each other, show the germs out of which they spring, and how they unfold themselves into that multiplicity and richness of *inner life* which are manifested in the mature man."*

We have passed in review some of the leading phenomena of the sensational and perceptive consciousness, and attempted to specialize the nervous apparatus through which they are respectively manifested. We have seen that ideation is the first stage in our intellectual progress, and we have glanced at its general bearings, in relation to our composite nature, as animal, moral, and intellectual beings. But knowledge that is *definite, exact, and communicable* belongs to a still higher phase of mental development than that of intuitive feeling and perceptive experience,—of the sensational and perceptive consciousness, which we have hitherto been considering. For in world-consciousness, as in self-consciousness, there is an individuality, an inward or subjective experience which is *unutterable* and *incommunicable*. The primary intuitions of all our perceptive faculties, even in regard to the phenomena of nature, but still more especially in respect to our social and moral relations, are closely interwoven with feeling, and, indeed, are often intensely felt, but on this very account they are *incommunicable*; for they cannot be *articulately expressed*, nor adequately conveyed by any system of signs from one mind to another. We can only judge of the intuitive feelings and perceptive experience of others by what we ourselves experience. No words can convey their equivalents;

* *Vide* Waitz's *Prospectus* to his "Lehrbuch," quoted by Morell in his "Elements of Psychology."

that is, can make others feel a sensation which we feel, or experience an inward light which reveals to us the primary elements of knowledge. There is, indeed, for the expression of absolutely individual feelings and emotions, a universal language, common to man and the lower animals—the language of Nature—*of inarticulate cries and of gesticulation*. The interjection comes nearest to this, but it has a certain amount of generality about it. In the case of the unfortunate deaf-mutes, the paramount importance of gestural language we see strikingly exemplified. To them, in their state of isolation and normal condition, left without the peculiar instruction which their situation requires, it is everything; independent of all conventional arrangements, and addressing itself principally, if not solely, to the sight, it is their only mode of communication with others. Thus, for instance, when they have beheld the raging passion of anger in another, and seen the swollen features, the distorted visage, the convulsed limbs; in a word, all the violence of action visible in anger, they can only tell of this to others by imitating the contortions and reacting the scene which they have witnessed. There cannot, indeed, be a doubt that “our minds are subject to a variety of feelings, and that the effects of these are visible in the features, attitudes, and gestures. Every distinct emotion has its appropriate expression, and thus a language altogether independent of words exists, displayed by the countenances and actions of man. Every person is aware of the bodily expression of fear, love, joy; and one can seldom ever mistake or confound the language of those with that of courage, hatred, or sorrow. Such language is immediately and instinctively recognised in every state of civilization, from the American savage to the most refined citizen. The haughty step, the erect carriage, and disdainful look, are always sure indications of pride; in the timid gait and sidelong look fear is at once perceived; while agony is always too fearfully portrayed in the distorted looks and agonized features of severe suffering. This language addresses itself to the sight; the deaf and dumb therefore are able to avail themselves perfectly of its use; and thus it possesses for them, through life, always a charm which written language appears rarely to acquire.”*

But knowledge, to be definite, exact, and communicable to others, must pass through the process of abstraction, and become embodied in the forms and symbols of the understanding, in *fine, in spoken or written language*. The intuitions of our perceptive faculties, *our idealized impressions*, which have been

* “The Deaf and Dumb; their Position in Society, and the Principles of their Education Considered.” By W. P. Scott, M.D., Principal of the West of England Institution for the Education of the Deaf and Dumb, London, 1844.

stored up in the memory as *mental images*, and *reproduced as representative ideas*, after having been associated, and when sufficiently generalized, have again to be projected out of the mind, to be externalized, and by the imaginative faculty, ideality, to be embodied in objective realities. But when once symbolized, or embodied in signs, our generalized ideas are no longer mere subjective representations; for, being thrown into fixed and significant types, which perform, though imperfectly, the office of abstract ideas, they exist in the mind, altogether apart from the region of immediate and inward experience, as *independent intellectual realities*; and, as such, become distinct and intelligible objects of contemplation, which can be placed at pleasure, either within or without the consciousness of the moment. In perception, as we have seen, ideation is effected in response to impressions made upon us *from without*, by virtue of the primeval harmony which exists between our perceptive faculties and external nature; but here *the mental process is reversed*, for the mind, separating itself from outward restraints, and impelled by its own inherent intellectual activity, by ideality, it embodies its inward images and representative ideas in objective realities. And this *objectifying* of our *inward* or *mental ideas* is all-important to our progress in knowledge. For, "until signs are employed, our mental images are not held clearly apart; they merge, like dissolving views, into one another. Our life, in fact, without them, would be more like a dream than a waking reality—portions of a thousand different ideas perpetually combining with and melting into one another. Language, on the other hand, forms a new world, in which all our mental processes are *objectified*, held clearly apart, and not only made distinct to ourselves, but so embodied as to be rendered likewise separate intellectual realities to other minds as well."*

When once, however, our intellectual activity, instead of *objectifying* our *inward images* in *existing outward* realities, constructs for itself the *sign, phonetic or visible*, for the embodiment of the *intellectual idea*—"the sign for the thing signified"—the mind reaches a still higher phase of development. For in the construction and through the instrumentality of language the mind rises above feeling, above perception, above all the inward images of the imagination, and creating a new external world of its own, into which it transfers the phenomena of its inner life, it achieves the first step in the *freedom of human thought*. "In language, the sign, whether spoken or written, is *objective*; it appeals to the *senses*; it comes to us from the outward world, and is constructed from the elements of nature around us. At the same time, it has no natural meaning, and contains no thoughts

* Morell's "Psychology," p. 184.

apart from the mind which created or uses it. Its whole essence consists in its being the embodiment of an idea; in brief, *it is idea objectified*.*

Language is thus an intellectual instrument intermediate between perception and thought, and written notional words are the symbols or representatives of objectified ideas. All notional words, indeed, belong to the region of representative ideas, after these ideas have attained their most general character; and though words cannot excite the feelings like a gesture, nor warm the imagination like a picture, they are the indispensable machinery in the process of generalization and abstraction. Through them we grasp the essential elements which distinguish one thing from another, and classify our multifarious experiences. "In this way it is that they serve to construct the more general outline of knowledge. Hence the wonderful power which words possess on the whole process of thought; hence the capacity they attain, after the teachings of experience have paved the way, for expressing the very essence of the things to which they relate; hence, too, their use in forming a broad platform, on which the results of all the lower processes of mind are plainly recorded, and from which we can commence those higher forms of activity, which give to reason its all but infinite range and all but omnipotent force."†

To the unfortunate, but educated deaf mutes, cut off from "hearing the mirror of speech," and denied the gratifications which flow from the interchange of ideas through the medium of "sweet sounds," written language is *speech in visible forms*, and written words, as the symbols or representatives of *objectified ideas*, are regarded by them as units, in the same way as we regard letters, the various objects around them being so many simple objects of thought. "In the minds of the deaf mutes, written words," says Dègénérodo, "awaken the conception of things themselves, in the same manner as they awaken in ours the conception of sounds, with this difference, that polysyllabic words recal to them but a single idea, while to us they record a number of sounds at once." Nor can there exist a doubt that our alphabetic writing, losing its *phonetic* character, becomes to them truly *ideographic*.‡

Their association, however, of ideas with written language must necessarily give to it a very different character from that which obtains with us, who enjoy the blessings of speech and

* Morell's "Psychology," p. 184.

† Ibid.

‡ Jerome Condon, a learned professor of Pavia, so early as the sixteenth century, says,—“Writing is associated with speech, and speech with thought; but written characters and ideas may be connected together *without the intervention of sounds*, as in hieroglyphic characters.”—See “Journal of Education,” No. 6, p. 204.

hearing. So universal, indeed, is the practice of associating *ideas with sound*, it is not without difficulty that we can conceive the possibility of associating written characters with ideas without the intervention of sound. We learn to speak long before we learn to read or write; and thus, in the natural order of things, articulate sounds become the representatives of ideas, and written characters the representatives or symbols of sounds. Besides, hearing and sound are fitted to each other, and are in such intimate relationship, that hearing has been aptly designated "the mirror of speech." And thus it is, that while in articulate speech the mental image or intellectual idea, which has been moulded for expression in the organ of language, finds utterance by the lips, through the agency of the volitional power, the articulate sound—the spoken word—is reflected back, and returns again by *hearing* through the ears, first to the perceptive, and thence to intellectual consciousness.

The function of articulate speech is the exclusive prerogative of man, and language is common to all the races of man. It is the crowning gift of his beneficent Creator; "for to be without language, spoken or written, is almost to be without thought. We must not think, in a speculative comparison of this sort, of mere savage life; for the rudest savages would be as much superior to a race of beings without speech, as the most civilized nations at this moment are, compared with the half-brutal wanderers of forests and deserts, whose ferocious ignorance seems to know little more than how to destroy or to be destroyed. In our social intercourse, language constitutes the chief delight—giving happiness to hours, the wearying heaviness of which must otherwise have rendered existence an insupportable burden. In its more important character, as fixed in the imperishable records which are transmitted in uninterrupted progression from that generation which passes away to the generation which succeeds, it gives to the individual man the product of all the creative energies of mankind, extending even to the humblest intellect, which can still mix itself with the illustrious dead, the privilege which has been poetically allotted to the immortality of genius, of being 'the citizen of every country, and the contemporary of every age.' "*"

It is as natural for man, constituted as he is, and endowed with the faculty of speech, when vividly affected, to give expression, and to find utterance in articulate sounds, to his feelings, emotions, ideas, and thoughts, as it is for him voluntarily to use his locomotive powers in progression. But the scream of alarm, shriek of horror, and the laugh of surprise, like the scowl of
 1, are *natural signs*, and *not conventional ones*, like arti-

* Brown's Lectures on the "Philosophy of the Mind."

ulate words. Still, thought and language are almost inseparably associated, and it has been well observed—"Were a family of men to be created by a miracle in a wilderness, they would, if similarly endowed like ourselves, *feel the impulse of the faculty of speech*, and soon learn, in the first instance, to comprehend each other's gestures and cries, and other signs of natural language, and ascend by these means to the, exalted acquisition of an artificial language, by giving, step after step, conventional names to objects and actions, emotions and passions, generalizations and abstractions."* Thus, to the natural language of inarticulate sounds, gestures, and actions, would be added the conventional language of signs, until, in the fulness of time, alphabetical writing and the invention of printing consummated the benefits derived from the *noble prerogative of speech*.

Gall was the first to enunciate that the cerebral seat of the *faculty of speech* is in the anterior lobes of the brain; and since his time, as I have elsewhere observed,† a great mass of evidence has been collected in support of his localization of the organ.

"In 1848, two memoirs were read before the Académie Nationale de Médecine de Paris—one by M. Belhomme, 'De la Localisation de la Parole dans les Lobes Antérieurs du Cerveau;' and the other, by M. Bouillaud, entitled 'Nouvelles Recherches Cliniques Propres à Démontrer que le sens du Langage Articulé et le Principe co-ordonnateur des Mouvements de la Parole résident dans les Lobules Antérieurs du Cerveau,' containing new observations made by him since the date of his former paper, in 1839.

"The subject has undergone much discussion in France, and opposing evidence has been adduced. Andral‡ gives the particulars of two cases—one, in which loss of speech was the only cephalic symptom; and another, where it was complicated with hemiplegia of the right side, but the intellect was unaffected. They were both in old women, the first eighty, and the other seventy-three years of age. In the first case the speech was lost, all at once, but not in a fit, three years before her death. She was never known to have lost her consciousness, nor the power of sensation or motion. Andral says—"Tout semblait nous annoncer que l'intelligence avait son intégrité. Dans les quatre membres, les mouvements étaient libres, faciles, et la malade sentait bien les impressions douloureuses qu'on cherchait à faire naître sur la peau qui les recouvre. Lorsqu'on lui demandait si elle souffrait de la tête, ou si elle en avait souffert, elle répondait par un geste négatif.

* "Memoir of Dr. Spurzheim." By A. Carmichael, M.R.S.A.

† Case of Hemiplegia, with cerebral softening, and in which loss of speech was a prominent symptom. By Robert Dunn, F.R.C.S. Read before the Royal Medical and Chirurgical Society of London, June 25, 1850, and published in the "Lancet," Oct. 22, and Nov. 2, 1850.

‡ "Clinique Médicale—Maladies de l'Encephale, Vol. v. p. 454.

L'ouïe, la vue, et l'odorat, s'accomplissaient comme dans l'état normal.' At the autopsy, in the left hemisphere there was found a small ramollissement, of the size of a large pea—'Au niveau et en dehors de l'extrémité postérieure du corps strié tout-à-fait à sa pointe;' and in the right hemisphere a similar ramollissement—'À l'union de la moitié antérieure avec la moitié postérieure de cet hémisphère, à une égale distance de ces bords interne et externe, et au point de jonction des deux tiers supérieurs avec le tiers inférieur de la masse nerveuse située du centre ovale de Vieussens.' These were the only cerebral lesions. In the second case—'Dans tout l'encephale, il n'y a d'altéré que le corps strié du côté gauche.' It was a soft, pulpy mass to within three lines of its exterior surface. Andral observes—'Le siège du ramollissement est digne de remarque; il est exactement borné à l'un des corps striés, ce qui n'empêche pas qu'il n'y ait paralysie des deux membres et abolition de la faculté de parler.' Other cases have been recorded, in which the structural lesion was confined to the corpora striata, and a few in which the middle and posterior lobes were implicated in the disease of the striated bodies.

"But, in the consideration of this subject, it is never to be forgotten that the perfect power of speech—that is, the power of giving utterance to our thoughts and ideas in suitable and appropriate language, *depends upon the due relation between the centres of intellectual action, and of the encephalic motor centres, through which the volitional power is exercised.* Thoughts or ideas may be moulded for expression in the seat of intellectual action, but the due agency of the volitional power, to give them utterance, requires the integrity of the commissural fibres, and of the motor centres, through which the volitional impulses of thought operate in speech. The imperfect power of articulation which we so constantly meet with in hemiplegic patients, I have no doubt is owing to some structural lesion in the integrity of the motor centre of volition; and hence does it not necessarily follow that loss of speech or power of utterance will alike result from *disease of the anterior lobes, or of such parts of the corpora striata as are in direct relation with them?*

"There is not, I believe, a single instance on record in which the power of utterance was retained *intact*, however sound and healthy the great hemispherical ganglia may have been found, where the corpora striata were both diseased. The apparently conflicting evidence which has been adduced as to the seat of the faculty of speech admits of a satisfactory explanation, when thus considered in relation to the centres of intellectual action and the motor centres of volition."

I brought this view of the subject under the notice of the Royal Medical and Chirurgical Society in a paper, "On a Case of Hemiplegia with cerebral softening, and in which the loss of speech was a prominent symptom," read June 25, 1850,* and I

* The case was that of a lady advanced in years, who had suffered from three attacks of apoplexy. The first occurred in October, 1844, seemed "congestive" in its character, and passed away without any other permanent consequences than this, that she continually used one word for another, not applying appropriate

may here reiterate, my own mind rests in the conviction, that the amount of pathological and other evidence which has been amassed, irresistibly establishes the position of Gall, as to the site of the organ of the faculty of language in the anterior lobes of the brain, and that the power of articulate speech, that is, of giving utterance in appropriate language to our thoughts, feelings, and emotions, requires the integrity of the *corpora striata*, and *their commissural fibres*, as the *motor channels*, through which the *will or volitional power operates in speech*. A striking and instructive illustration was presented, in the young woman's case to which I have so frequently alluded, of the dependence of the power of utterance in articulate speech upon the due relation between the centres of intellectual action and of the motor centres, through which the will operates in speech. In her case, the perfect integrity of the *corpora striata* was abundantly manifest, for they were in the full play of their functional power, as *motor centres*, but she was *speechless* so long as the perceptive and intellectual faculties were in abeyance. Ideas, indeed, are the pabula of thought, and articulate speech is the interpreter and minister of thought. As we are now constituted, our thoughts are invariably clothed and find utterance in speech;

names to the things or persons she desired to signify. The second attack, in May, 1847, left her permanently hemiplegic on the right side, the power of voluntary motion being completely abolished, and but little sensibility being preserved, though reflex movements could be excited, in the lower extremity, by tickling the sole of the foot. For the remainder of her life she remained altogether *incapable of speech*, not being able to say *yes* or *no* in reply to a simple question, and never getting beyond the utterance of the monosyllable *dat—dat*; yet all her senses were intact; *the motions of the tongue were free, and there was no difficulty of deglutition*. She did not seem to have lost any of her intellectual powers; but her emotional sensibility was rather increased. Her general health continued good up to the time of the last fatal seizure, which occurred in April, 1850, without any premonitory symptoms.

At the *post-mortem* examination, the upper two-thirds of the *anterior lobe* of the *left hemisphere* was found to be in a state of complete destruction, with colourless softening; while the middle and posterior lobes were sound and healthy. The *right hemisphere* was healthy; but the greatest change was in the ganglionic masses, at their base, and in the commissural structure. The upper half of the *corpus striatum* on the *left side* was destroyed by softening; the optic thalamus was shrunken to less than half its natural size, its upper surface being greatly wasted; while, on the *right side*, a small and recent apoplectic clot was seen on the upper and anterior surface of the *corpus striatum*, the whole of the upper half of which was in a state of *ramollissement*; while on the outer surface of the thalamus also were noticed some indications of white softening. The *corpus callosum* was destroyed, except at its anterior and inferior reflexion, and the anterior commissure and fornix were gone. Microscopic examination of the softened parts presented an abundance of compound cells and of fatty matter in the capillaries. In this case it is quite evident that, with the disorganization of the left anterior lobe, its functional power was entirely abolished; and though the right hemisphere was healthy, and there is every evidence, from the history of the case, that it maintained and exercised its functional power as a centre of intellectual action, still the volitional agency was *wanting to give utterance to the passing thought*, for the *corpus striatum* on the same side was not in its integrity.

but without ideation, without mental images and representative ideas, there could be no thoughts; and *without thought language would cease*. But thought there may be, and in the case of the unfortunate and uninstructed deaf mutes, thought there is, independent of, and without language. Nay, without speech, man, by virtue of his perceptive organs, and intellectual faculties, can observe objects, and mentally arrange, associate, and form them into groups. He can judge of their properties and qualities,—compare them, and even deduce inferences;—but how weak and incomplete are these processes of thought when language is wanting! Without language the mighty triumphs which science has achieved over nature would have been impossible; and without the machinery of words, how limited and contracted would be the process of generalization and abstraction! Language implies a train of thinking. We reproduce in speech the mutual relations of objects, the relations of our thoughts to objects, and, the order and relation of our thoughts themselves. Words, as we have seen, are purely conventional; they have no natural meaning of their own, and contain no thoughts apart from the mind which created and uses them.

They are, in fact, the final expressions of that mental process as well as the depository of its final results, consummated through the instrumentality of the faculty of language, by which knowledge becomes *definite, exact, and communicable*, and through which the mind, elevated above the region of mere ideation, increases in intellectual activity and rises to a higher phase of development—that of *thought and reason*. Logic expounds the *laws of thought and the art of reasoning*. But, as the *instrument of thought and reasoning*, the value and importance of language cannot be overrated. For language implies a train of thinking;—it is the circulating medium of our thoughts—the minister of thought and its interpreter. Words are the materials of thought. For our mental images, *reproduced* in the memory as representative ideas or conceptions, when embodied in the conventional symbols of words, become *fixed and definite objects of thought*, and such they are to all who use them. Nay, according to Leibnitz, words are sometimes more than the signs or symbols of thought—they become *thoughts*. Such are his *symbolical cognitions or conceptions*. Among all the races of man, the instinctive impulse is irresistible to give utterance in articulate sounds to his feelings, emotions, and thoughts; and not only to fix upon articulate sounds, or names, as the representatives of his *intuitive cognitions or conceptions of things*, but also to find expressions for the *different qualities and states of things*. From such beginnings, “to all the uses and powers of articulate sounds and artificial language, how

exalted is the ascent! how immense the efficacy and enjoyment possessed by man! the intercommunion of minds in social or scientific converse—the force and perspicacity of argument advanced to such a degree by general terms and intellectual abstractions—the strains of poetry, inculcating piety, magnanimity, and virtue—the thunders of eloquence, commanding the destinies of nations, and involving in its splendid career the interests both of time and eternity.”*

The constructive faculty of language in continuous speech, involving, as it does, *the power of combining words together*, so as to express the mutual relations of objects—the relations of our thoughts to objects, and the order and relation of our thoughts themselves; thus enables us, through our reasoning and reflecting faculties, to judge explicitly of these relations, and to frame a method by which our judgments may be articulately expressed. And in this way it is that continuous speech becomes moulded, step by step, into a complete organ of thought, and that “a sentence or proposition in language answers to a complete thought in psychology. By a *complete thought*, in the sphere of the understanding, is meant, a *distinct act of comparison between two terms, in which we apprehend the relationship that exists between them*. All logical or formal thought answers to this explanation; and *the mental activity*, by which we compare terms, find out their exact agreement or disagreement, give expression to this in propositions, and deduce other propositions from them, is that which, *par excellence*, bears the title of THE UNDERSTANDING.”†

Carmichael, *ante cit.*

† Morell's “Psychology.”

CHAPTER V.

Recapitulation.—*Consciousness an ultimate Fact, and the universal Condition of Intelligence.*—*Phenomena and Nervous Apparatus of the Sensational, Perceptive, and Intellectual Consciousness.*—*The Sensory Ganglia the seat of the Sensational, and the Cerebrum both of the Perceptive and Intellectual Consciousness.*—*Two distinct Series of Convolution in the Cerebrum.*—*Difference in their office or functional Endowments.*—*Importance of the Facts of Developmental Anatomy.*—*Unconscious Cerebration.*—*Ideomotor Phenomena and Cerebral Reflex Action.*—*Conclusion.*

Recapitulation.—Consciousness we have viewed in the light of an *ultimate fact*, beyond which we cannot go,—as the *distinguishing* attribute of animal life ; and self-consciousness as the *primary condition of intelligence*,—in a word, as *mental existence*. It is, in fact, equivalent to the knowledge which we possess of our own personal identity, for it is implied in every sensation which we experience, and in every mental act that we perform—in *feeling, perceiving, thinking, and willing*. *Consciousness and immediate knowledge* are universally convertible, and psychology itself is only developed consciousness. Reid and his follower, Dugald Stewart, were clearly in error in restricting the function of consciousness to that of a *particular faculty*, co-ordinate with the other intellectual powers, instead of regarding it as *the universal condition of intelligence*. For—

“ In consciousness, as the original spontaneity of reason (*νοῦς, locus principiorum*), are revealed the primordial facts of our intelligent nature. Consciousness is the fountain of all comprehensibility and illustration, but *as such* cannot itself be illustrated or comprehended. To ask how any fact of consciousness is possible, is to ask how consciousness itself is possible ; and to ask how consciousness is possible, is to ask how an intelligent being like man is possible.”*

Now, we can best conceive of consciousness, as “ one and indivisible ” in relation to time, as an incalculably rapid succession of acts or states, and as passing from the moment of birth—the helplessness of infancy—to the maturity of age, through a progressive series of developments—through the different phases of

* Sir William Hamilton.—*Vide* “ *Edinburgh Review*,” vol. lii. p. 176.

sensational, perceptive, and intellectual consciousness. To FEEL, TO PERCEIVE, AND TO THINK, or, in other words, *sensation*, *perception*, and *intellection*, are distinctly progressive stages in our psychological progress. They are the three great and distinguishing phases of mental activity and development, under which are comprised all our psychological phenomena, of whatever kind; and they each severally have and require, for the manifestation of their respective phenomena in this life, *a distinct organic instrumentality*, of corresponding elaboration and complexity, in the nervous apparatus of the cerebro-spinal system of man.

Sensori-motor, consensual and instinctive feelings and actions, are the phenomena which formulate the sensational consciousness; to these are superadded, *ideation and volition, with their associates, memory and emotional sensibility*, as the essential phenomena of the perceptive consciousness; and to these, *imagination, imitation, articulate speech or language, ratiocination, and the processes of thought and reflection*, as the distinguishing attributes of the intellectual consciousness.

But to ask a *reason*, as Sir William Hamilton has justly remarked, for the possibility of our *intuitions*, sensational or perceptive, above the *fact of their reality or consciousness*, "betrays," as Aristotle has truly said, "*an imbecility of the reasoning principle itself*;" for the facts, *as ultimate*, are inexplicable. "What we do know of self, or person, we know only as given in the consciousness: there is revealed to us, as an ultimate fact, a *self* and a *non-self*; each given as independent—each known only in antithesis to the other. And no belief can be more *intuitive*, *universal*, *immediate*, or *irresistible*, than that this antithesis is real, and known to be real; and no belief is therefore more true."*

Whatever may be the notion entertained of the abstract nature or essence of mind, one thing is manifestly obvious, that the sensori-motor phenomena—in other words, that *sensibility* and *motility*—indicate its primordial points of contact with the external world or nature. And as to the universality of *instinctive endowments*, Sir Henry Holland has well observed:—

"Wherever there is organization, even under the simplest form, there we are sure to find *instinctive action*, more or less in amount, destined to give the appropriate effect to it. This is true throughout every part of the animal series, from men and the quadrumana down to the lowest form of infusorial life. When we consider how vast this scale is—crowded with more than a hundred thousand recognised species, exclusively of those which fossil geology has disclosed to us—we may be well amazed by the profuse variety of *instinctive action*; as mul-

* Vide "Edinburgh Review," *ante cit.*

tiplied in kind as are the organic forms with which it is associated, and all derived from one common POWER—that of *instinct*.”*

But amazing as this may be, are we not still more in “wondering mazes lost,” when we reflect upon *all* the endowments of the *primordial cell* (vegetable or animal), with its *granular nuclei*, microscopically minute, and upon the *community of function* of its ultimate constituents; bearing in mind, at the same time, that within this *solitary cell* are potentially contained not only the *instinctive activities* above indicated, ranging from the infusoria up to man, but the perceptive, the affective, and the intellectual faculties of every class,—the god-like attributes of man himself, and even distinguishing peculiarities and idiosyncrasies hereditarily transmitted from parent to offspring?

Of the three forms of mental activity—the sensational, perceptive, and intellectual, and under which all our varied psychological phenomena arrange and group themselves—*self-consciousness* is the earliest, and consequently the lowest, phase of development; for in it the mind at first exists in a state of bare receptivity. The senses, indeed, come into play from the moment of birth, and soon acquire the utmost perfection of which they are capable; but the *intelligence* is purely sensational, the *feelings* are simply those of pleasure and pain, and the *impulses to action* are innate and instinctive. In perceptive or *world-consciousness*, an increasing amount of mental activity obtains, arising from the conflict of the perceptive faculties of the mind with the external world or nature. Indeed, all our *immediate knowledge*, of whatever kind, is intuitive, and has its origin in perceptive experience. Here we have superadded to sensational, the *perceptive intuitions*, *ideation*, and the *cognition of outward realities*; to sensorial feelings, the *emotional and moral sensibilities*; and to innate and instinctive impulses, *volitional powers* and *intelligent actions*. But it is in the *intellectual consciousness* that the mental activity reaches its culminating point, in the region of *representative knowledge*. It is here, through imitation, imagination, and ratiocination, that the mind attains to its highest phase of development—grasping, through the range of the intellectual and reflecting faculties, *abstract ideas*, and *necessary and universal truths*, and finding articulate utterance and expression for them through the faculty of speech in language.

Now, nervous actions are of a threefold character—*physical*, *sensory*, and *voluntary*. There are—

1st. The physical and reflex actions of the excito-motory system, which occur *without sensation*;

2ndly. The sensori-motor—the consensual and instinctive actions of the sensational consciousness; and

3rdly. The voluntary—the volitional, emotional, and intelligent actions of the perceptive and intellectual consciousness.

We recognise and detect the first of these, the physical and reflex, exclusively *only* in the lowest animal organisms. They are essentially automatic, and occur *without sensation*. The sensori-motory actions are typical of animal life, and in conjunction with the first, or excito-motory, characterise the whole of the invertebrate sub-kingdom; whilst in the vertebrate series, to the first and second, the third, or purely voluntary, are super-added, and constitute the distinguishing feature of the cerebro-spinal system.

Accordingly, the nervous system of man, from the nature of its office, and its functional endowments, admits of a threefold division also, into—

1. The physical or excito-motory, and reflex—the *true spinal system* of Dr. Marshall Hall;

2. The nutritive and secretory, or ganglionic system; and

3. The sentient, psychical, and voluntary, or cerebro-spinal system.

But it is only with the last of these, the cerebro-spinal system, that we are now more immediately concerned; for the physical or excito-motory phenomena are *without* the domain, and *beyond* the control of intelligence,—and the reciprocal relations of the ganglionic and the cerebro-spinal systems have but an indirect though most important practical bearing upon our present subject of inquiry. As we have said, in its totality, the nervous apparatus of the cerebro-spinal system comprises the *organic instrumentalities* through which the phenomena of sensation, perception, and intellection are manifested in this life; in other words, the nervous centres of the sensational, perceptive, and intellectual consciousness. Now, we have seen that the sensory ganglia are the seat of the sensational consciousness of whatever kind, and not only of sensorial, but of emotional feeling; and that the cranio-spinal axis, and the corpora striata at its summit, are the centres and source of all the movements of the body—reflex, sensational, emotional, and volitional; so that the nervous apparatus of the sensational consciousness—the system of automatic life and instinctive action, subservient to sensation, and to those consensual and instinctive actions which are indissolubly linked on with sensations—consists of the spinal axis and nerves, the medulla oblongata, and the chain of sensory ganglia, including those of the special senses at its summit. For, as I have before observed, if we follow up the cranial prolongation of the spinal cord, the medulla oblongata, into the fibrous strands of which

we see imbedded *the respiratory, auditory, and gustatory ganglia*, and carefully trace out its ramifying branches, we find it sending off distinct fasciculi of fibres to the ganglionic centres at its summit, to the *cerebellum*, the *corpora quadrigemina*, the *thalami optici*, the *corpora striata*, and to the peduncles of the olfactory ganglia, and thus to *the sole exclusion of the cerebrum*, which is an organ superimposed and superadded, and whose connexions are strictly *commissural*, the whole series of the ganglia of the cerebro-spinal system, including those of the spinal senses, are in direct fibrous connexion with the cranio-spinal axis, forming with it, as an aggregate or whole, *the sensorium commune, or great circle of sensational consciousness, and of consensual and instinctive action*.

Now, as the functions of an *independent centre of action*, seated in a *distinct nervous apparatus*, the phenomena of the sensational consciousness are not to be confounded with volitional or intelligent actions. But upon this nervous apparatus of the sensational consciousness, for the purpose of combining and associating, in the development of the active powers of his mind, instinctive impulses, sensational feelings, emotional and moral sensibilities, with the higher intellectual activities, and for offices and purposes the noblest and most exalted in the economy of man, there is superimposed and superadded—the *cerebrum*, or great hemispherical ganglia, and which, in its totality, is the seat of the instruments or organs both of the perceptive and of the intellectual consciousness. For if there be one point in the physiology of the brain more unequivocally demonstrated than another, it is this—that these ganglia are the instruments of intellectual action and volitional power; and that, wherever they exist, even in their simplest rudimentary condition, when compared with their complex and full development in man, there we invariably find manifested the essential phenomena of the perceptive consciousness—*ideation, memory, and volition*.

Restricting the functions of the cerebrum solely to perceptive and intellectual operations, to *the entire exclusion of sensation*, Dr. Carpenter, to my mind, has fully established the composite nature of the animal propensities and social affections, and of the emotional, moral, and religious feelings of man; and has admirably shown, that in the exercise of each there is a *perceptive or ideational element*, as well as *sensorial feeling*, involved. And here it is worthy of remark, that that sagacious metaphysician, Mr. James Mill, in his contemplations on human mind, apart from all physiological considerations, had previously arrived at the same conclusions. The separation and localization, within the encephalon, of the nervous centres of sensation and of ideation, of feeling and of thought, is a real and an acknow-

ledged step in advance on the physiological psychology of man, and it is one which has yet to be fully appreciated, in all its variety of bearings, in relation to the practice of psychological medicine.

Now, although the cerebrum, in its totality, is indisputably the seat of the organs both of the perceptive and of the intellectual consciousness, perception and intellection are not to be confounded with each other.

To perceive and to think are distinct mental processes, and they have—for they must require—distinct organic instrumentalities for the manifestation of their respective phenomena. Perception is but one and the first step above sensation; its intuitions are closely interwoven with feeling, and are often, indeed, intensely felt. It is intermediate between sensation and intellection, and it is the portal to intellectual action, for the intuitions of its faculties furnish the *pabula of thought*. But intellection is the highest, the crowning phase of mental development and introspective or reflective consciousness—the distinguishing attribute of humanity—and as to *feeling*, it finds no place in the constitution of abstract ideas, or in the processes of logical reasoning.

Perception speaks to us from *without*, and intellection from *within*; for whilst, in the perceptive consciousness, ideation is affected, in response to impressions made upon us from *without*, by virtue of the primeval harmony which exists between the perceptive faculties of the mind and external nature,—in intellection, the *mental process is different and reversed*; and the mind, separating itself from outward restraints, and impelled by the inherent activity of its intellectual faculties and reflecting powers, embodies idealized impressions and perceptive intuitions—its inward images and representative ideas, in *objective realities*. Thus symbolized or objectified, they are removed from the region of immediate and perceptive experience, and exist in the mind as independent intellectual realities, and become *fixed and definite objects of thought*, and which can be placed at pleasure either within or without the consciousness of the moment. In this way it is that the mind, impelled by the *imitative faculty*, by means of the hands and chisel, moulds, forms, and fashions images of the objects of nature, into which it has embodied its own generalized ideas; and so, again, urged on and impelled forward by the same imitative faculty, by means of the hands and the pencil, it delineates and produces pictorial representations of the idealized objects;—*such were the hieroglyphics of old*. But still the mind cannot be said to have achieved its first step in the *freedom of human thought* until it has created, invented, and constructed its own sign, phonetic or visible, for the embodiment of the intellec-

tual idea; and such, as we have seen, is *language*—for, in reality, “*it is idea objectified.*”

It is important, physiologically as well as psychologically, to bear in mind the *distinction* between *immediate* and *representative* knowledge, and the difference in *their origin or source*. For all our immediate knowledge, of whatever kind, is *intuitive*, and has its origin in perceptive experience—in the direct intuitions of the perceptive faculties; and all representative knowledge is the *product* or *creation* of the mind's intellectual and reflecting powers.

Now, in the structure of the cerebrum there are manifestly two well-marked and distinct series of convolutions. *There is a longitudinal, and there is a transverse series*; and my own mind rests on the conviction, that the *functions* of these two distinct series of convolutions are *different*; and that the former, or longitudinal series, constitutes the nervous apparatus of the perceptive, and the transverse series that of the intellectual consciousness.

But, besides these two distinct series of convolutions, there is a third or commissural series in the cerebrum, and through the instrumentality of which the *intuitions* of the perceptive are brought into association with the *higher activities* of the intellectual consciousness. Such are the *internal anastomosing convolutions*, the third order of Foville, which connect the *ourlet*, or great internal, with the transverse convolutions on the surface of the cerebrum—the common central organs of the perceptive, with those of the intellectual consciousness.

Foville, as we have seen, has invested the *locus perforatus*, or quadrilateral spot, with peculiar interest; considering it, as he does, the nucleus, or starting-point, from whence all the other convolutions of the hemisphere are evolved. Nor can the fact be denied, that the *ourlet* of Foville, or great internal—the primitive basement convolution of the hemisphere—may literally be said to spring out of, or to be evolved from, the *locus perforatus*, and that all the other longitudinal convolutions of the hemisphere are directly connected and associated with this primitive basement convolution; forming as a whole, in the aggregate, in my opinion, the nervous apparatus of the perceptive consciousness. But it is equally true that the transverse series of convolutions on the surface of the cerebrum have no direct connexion either with the *locus perforatus*, or with the *ourlet* of Foville. They are a distinct series of convolutions; and it is through a system of internal anastomosing convolutions that these transverse convolutions are brought into association with the central organs of the perceptive consciousness. They constitute, in my mind, the nervous apparatus of the intellectual consciousness, for they are

essentially human; and it is only where they do exist, and in the ratio or proportion of their existence, among the lower animals, that we find and detect any traces of ratiocination and of intellectual action.

Foville has traced out and demonstrated the connexions of all the other primitive longitudinal convolutions of the cerebrum with the basement convolutions of the hand; and Plate XII. of the Quarto Atlas to his "Traité Complet de l'Anatomie, de la Physiologie, et de la Pathologie du System Nerveux-Cerebro-Spinal," is "destinée montrer les rayonnements de l'ourlet fibreux dans les circonvolutions de la face interne de l'hémisphère." In this plate, with the great commissure divided in the mesial line, there is seen, above the corpus callosum, a vertical section of the great internal convolution—the *ourlet* or hem of the hemisphere—its concentric circumference—surrounding it internally like a riband, and attached at each extremity to the *locus perforatus*. The great marginal convolution of the longitudinal fissure is seen forming the eccentric or outer boundary of the hemisphere; and between these, crossing the internal surface of the hemisphere, are displayed the convoluted branches which unite them with the anterior, middle, and posterior longitudinal convolutions of the brain, establishing the connexions, and forming a sort of anastomosis of the basement convolutions with all the other primitive convolutions, and with the *transverse convolutions*, on the *convex surface of the cerebrum*. In Plate X. is represented the external surface of the hemisphere. All the convolutions of the convexity of the hemisphere are seen running, from the convolution around the fissura Silvii to that which encircles the hemisphere, the great marginal one. The transverse superciliary, medio-parietal, and occipital convolutions are displayed, and, besides their connexions with the two convolutions of the second order, their anastomosis with each other.

The great internal convolutions, as I have said, are clearly the primitive basement convolutions of the hemispheres; and we recognise their homologues in the thin laminæ of vesicular matter which encrust the corpora striata in the brain of the fish. Forming, as they do, the concentric or inner circumference of the hemispheres, as the great marginal convolutions do their outer boundary, must they not necessarily be the primary and common portals to intellectual action—the great central organs of the perceptive consciousness—the seat of ideation, memory, and volition? For, be it remembered, that it is in the case of the fish, where their representatives are reduced to mere laminæ or crusts, covering the corpora striata, that we have the earliest instance, and the first clear and distinct evidence, of the exercise of *perception*, *memory*, and *volition*, as opposed to mere consen-

sual and instinctive actions. These convolutions of the band constitute the distinctive and boundary lines of demarcation between the *sensory* and *perceptive ganglia* of the encephalon—between sensation and ideation. They are, in fact, the common portals to intellectual action and volitional power—the seat of *ideation*, *memory*, and *volition*. It is *here* that sensory impressions—the intuitions of all the organs of the special senses—are *idealized* and *registered*, *perceived* and *associated*, and that the *ideation* or *world-consciousness* of external existences—the things, which we see, feel, taste, and smell—is effected; and it is from *here* that the mandates of the will issue. We have seen that with these central organs and fundamental convolutions are directly connected and associated all the other longitudinal convolutions in the anterior, middle, and posterior lobes of the brain, administering to the several perceptive ideational activities of man, and to the development of his composite nature as an animal and social, a moral and religious, as well as an intellectual being.

Now may it be fairly concluded, that the intuitions not only of all the special senses, but also of all the perceptive faculties, are *perceived* by us through the central organs of the perceptive consciousness? Most certain it is that we have an æsthetic sense of the true, the beautiful, and the good,—moral intuitions of right and wrong, and emotional of awe, veneration, and reverence, which come to us before all teaching,—and indeed, that the elements of all our immediate knowledge, physical, moral, and religious, have their origin or source in perceptive experience.

To determine the special functions of the primitive convolutions is the great problem of physiological psychology; and although something may be said to have been done towards its solution, much remains to be accomplished, for the problem is virtually unsolved. Nor can this be a matter of surprise, when we consider its conditions and requirements.

The natural history of the development of the cerebrum, throughout the whole vertebrate sub-kingdom, is but the first step in the process, and it is one that has been or may be accomplished; but the far more difficult task remains,—a work of labour as necessary as it is difficult,—that of studying the characters, habits, and behaviour of the animals throughout the series,—their animal and social propensities, and intellectual activities, in connexion with their respective cerebral developments; and how few are there among us who possess the mental endowments and requisite qualifications, and can command opportunities, even on a limited scale, for such an undertaking. But, "*Nil, sine magno labore, debet mortalibus*;" and with such active labourers in the field as Holm, Vimont, and Frederick Cuvier have proved themselves to be, great things will assuredly,

in the process of time, be accomplished in furtherance in this direction of the study of the physiological psychology of man.*

The facts, indeed, of developmental anatomy, comparative and human, point to the most important deductions, for they indisputably prove—firstly, that the perceptive faculties of our physical experience or knowledge, subservient to our cognition of external objects, their sensible qualities and physical attributes, the phenomena of their action, or events, and their relative relations, arrangement and number, &c., must have their “local habitation and abode” in the convolutions of the anterior lobes; secondly, that the posterior lobes, as exclusively human, must necessarily be the seat of the exclusively human affections, and administer to our social affections; and thirdly, the inference appears to be legitimate, that the convolutions of the middle lobes are the seat of the personal affections of the ego, and of the social,

* Professor Owen has proposed a fourfold primary division of the mammalia, based upon four leading modifications of the structure of the cerebrum, under the following designations:—

1. *Lyencephala* (λύω, to loose; *εγκεφαλος*, the brain), the loose-brained implacentals, in which the great transverse commissure, or corpus callosum, is wanting—such are the marsupialia and monotremata.

2. *Lisencephala* (λίσσος, smooth), the smooth-brained placentals, where the corpus callosum is present, but the brain is not convoluted—such are the rodentia, insectivora, &c.

3. *Gyrencephala* (γυρῶω, to wind about), in which the superficies of the brain is folded into more or less numerous gyri, or convolutions, of which among the higher are the quadrumana and carnivora. The mammalian modification of the vertebrate type attains its highest physical perfections in the gyrencephala, as manifested by the bulk of some, by the destructive mastery of others, by the address and agility of a third order. And through the superior psychological faculties—an adaptive intelligence predominating over blind instinct—which are associated with the higher development of the brain, the gyrencephala afford those species which have ever formed the most cherished companions and servitors, and the most valuable sources of wealth and power to mankind.

4. *Archencephala*, *Homo* (Ἀρχω, to overrule). “In man,” says Professor Owen, “the brain presents an ascensive step in development, higher and more strongly marked than that by which the other sub-classes are distinguished. Not only do the cerebral hemispheres overlap the olfactory lobes and the cerebellum, but they extend in advance of the ope, and farther back than the other. Their posterior development is so marked that anatomists have assigned to that part the character of a third lobe; it is peculiar to the genus *Homo*, and equally peculiar is the ‘posterior horn of the lateral ventricle,’ and the ‘hippocampus minor,’ which characterize the hind lobe of each hemisphere. The superficial grey matter of the cerebrum, through the number and depth of the convolutions, attains its maximum of extent in man.

“Peculiar mental powers are associated with this highest form of brain, and their consequences wonderfully illustrate the value of the cerebral character, according to my estimate of which I am led to regard the genus *Homo* as not merely a representative of a distinct order, but of a distinct sub-class of the mammalia, for which I propose the name of *Archencephala*.”†

† Vide a paper by Professor Owen, ‘On the Characters, Principles of Division, and Primary Groups of the Class Mammalia,’ read before the Linnæan Society of London, Feb. 17th, and April 21st, 1857, and in the “Journal of the Proceedings of the Linnæan Society, for June, 1857,” vol. ii. No. 5.

moral, and religious intuitions—the distinguishing attributes of man.

The general harmonious accordance of these deductions with the multiplied cranioscopical observations of Gall, Spurzheim, and Combe, speaks in favour of their foundation in truth and nature; and I think it may be legitimately inferred that in the primitive basilar convolutions are seated the organs of the faculties subservient to the *formation of the inferior region* of the true or conscious mind. Thus, on the lowest plane of cerebral development, and of which we may recognise the analogies in the inferior vertebrata, the perceptive apparatus seems limited to the basement or internal convolutions, with their anterior and basilar connexions; that is, to the common central organs of the perceptive consciousness,—the seat of ideation, memory, and volition,—to the anterior perceptive organs, through the instrumentality of which, by the inlets of the special senses, we acquire a knowledge of the sensible qualities and physical attributes of external existences,—and to those basilar organs which administer to the preservation and maintenance of animal life. The *love of life* is paramount; and around the organs of the alimentative propensity are marshalled and associated those of the propensities subservient to the defence, protection, and conservation of existence. It may, indeed, be fairly inferred that the intuitions of the special senses and their allied feelings, appetites, and instincts, form the chief and predominant part of the mental life of the inferior vertebrata, while at the same time it must not be forgotten that these, too, constitute the inferior region of the true or conscious mind, and enter largely into the complicated web of human existence. Again, on a higher plane of development, and of which, too, we may recognise the analogies among the highest mammalian and quadrumanous groups, the longitudinal convolutions are carried upwards above the lower perceptive organs, and prolonged backwards even beyond the median lobes, and the perceptive apparatus is thus proportionately elaborated and extended.

Contrasting the endowments of the higher mammalia with the ruminants, in accordance with this is the remark of Leuret when describing the convolutions of the Indian elephant. "Suppose," says he, "that all the superior convolutions, and the prolongation of the great internal convolution which is united to them, to be obliterated, then the fourth anterior convolution might be united to the fourth posterior,—the third to the third,—and we should have one of the groups of convolutions of the brain of the ruminants and solipedes." It is through these superior perceptive organs that we rise above the bare perception of external objects, their sensible qualities and physical attributes, to that of the differences

and relations of things, their order or arrangement, and number, and to the phenomena of their action, or *events*, with the adjuncts of time and place. The higher individual or personal affections, too, such as the *love of self*, or *self-esteem*; the *love of approbation*; and *love for others*, or *benevolence*, are brought into play. But there is a still higher plane of perceptive development *exclusively human*, in which the towering longitudinal convolutions reach the fulness of their evolution backwards, and the nervous apparatus of the perceptive consciousness its most elaborate and complete development. The moral and religious intentions are the sole *prerogatives of man*, and they constitute an immutable distinction between him and the whole animal creation. In man's moral and religious attributes the lower animals do not participate. Equally destitute are they of those enduring, tender, and endearing relations which are the charm of his existence here.

- And now, may it not be fairly concluded, from the close proximity and intimate association of this highest plane of perceptive development with the *transverse series of convolutions*, that the exalted, pure, and holy intuitions of the one will be directed, guided, and strengthened by the dominating influence of the noblest faculties of the other; that through the latter, our æsthetic sense of the true, the beautiful, and the good will not always end in fruitless aspirations, but fructify; and that, also, through them, while they control, direct, and strengthen our moral intuitions of right and wrong, and our emotional of awe, veneration, and reverence, we will be led to see clearly the *basis* upon which *moral obligation* rests, and religion will become to us "a reasonable service," and ours an intelligent, voluntary, and cheerful dependence upon an *all-perfect Being*, infinite in wisdom, power, and goodness? It is in this association of the pure and elevating moral and religious intuitions with intellectual power that the *true greatness* of the human character consists; and, in fine, that from the joint operation of the highest perceptive faculties with the reasoning powers, from *observation* and *experiment*, result the creation of science and the achievements of science.

- "For the proper function of reason is to create knowledge or science. The *understanding* alone can never do this. It can analyse, distinguish, form concepts, construct propositions, weave them into arguments—perform, in a word, any formal process within the data furnished to it—but it can never go beyond the barriers of its own definitions. When, however, we grasp a truth by the power of reason, on the other hand it implies far more than the attainment of a bare definition of it. It implies that we have penetrated to the centre; that we can trace its pedigree in the world both of matter and form; that we can regard it as one link in a connected chain, of which we are able to *tell* the ante-

cedents and *foretell* the consequents ; that we can recognise it, in fine, as a particular manifestation of some great and universal law, the operation of which we have learned to comprehend and apply.”*

In connexion with the *processes of thought*, we have evidence of an *automatic action* of the intellectual faculties, *unattended with consciousness*, designated *unconscious cerebration* by Dr. Carpenter, who was the first to bring it under the notice of psychological inquirers, and who, in support of its existence, has obtained the confirmatory experience of two of the most distinguished metaphysicians and profound logicians of the age—the late Sir William Hamilton and Mr. John Mill.

“Most persons,” says Dr. Carpenter, “who attend to their own mental operations are aware that, when they have been occupied for some time about a particular subject, and have then transferred their attention to some other, the first, when they return to the consideration of it, may be found to present an aspect very different from that which it possessed before it was put aside, notwithstanding that the mind has since been so completely engrossed with the second subject as not to have been consciously directed towards the first in the interval. Now, a part of this change may depend upon the altered condition of the mind itself, such as we experience when we take up a subject in the memory, with all the vigour which we derive from the refreshment of sleep, and find no difficulty in overcoming difficulties and disentangling perplexities which checked our farther progress the night before, when we were too weary to give more than a languid attention to the points to be made out, and could use no exertion in the search for these solutions. But this by no means accounts for the *entirely new development* which the subject is frequently found to have undergone when we return to it after a considerable interval—a *development* which cannot be reasonably explained in any other mode than by attributing it to the intermediate activity of the cerebrum, which has, in this instance, *automatically evoked the result without our consciousness*.”†

To the same effect is the following remark of Sir Benjamin Brodie :—

“It has often happened to me to have been occupied by a particular subject of inquiry—to have accumulated a store of facts connected with it, but to have been able to proceed no further. Then, after an interval of time, without any addition to my stock of knowledge, I have found the obscurity and confusion in which the subject was originally enveloped to have cleared away, the facts seemed all to have settled themselves in their right places, and their mutual relations to have become apparent, although I have *not been sensible* of having made any distinct effort for that purpose.”‡

And such, from personal experience, I conceive to be the

* Morell's "Psychology."

† Dr. Carpenter's "Human Physiology," 5th edition.

‡ "Psychological Inquiries," by Sir B. C. Brodie.

common experience of every thinking mind. I have already observed that *automatic* or *reflex action* is not peculiar to the true spinal system; but, on the contrary, that it is the common attribute of the sensori-motor, emotional, and cerebral systems, and that Dr. Laycock was the first to connect it with the cerebrum. Dr. Carpenter goes on to remark:—

“Strange as this phenomenon may at first sight appear, it is found, when carefully considered, to be in complete harmony with all that has been affirmed respecting the relation of the *cerebrum* to the *sensorium*, and the independent action of the former. Looking at all those automatic operations by which results are evolved without any intentional direction of the mind to them, in the light of *reflex actions* of the cerebrum, there is no more difficulty in comprehending that such reflex actions may proceed without our knowledge, so as to evolve *intellectual products*, when those results are transmitted to the *sensorium*, and are thus impressed on our consciousness, than there is in understanding that impressions may excite muscular movements through the *reflex* power of the spinal cord, without the necessary intervention of sensation. In both cases, the condition of this mode of independent operation is, that the *receptivity* of the *sensorium* shall be suspended *quoad* the changes in question, either by its own functional inactivity, or through the temporary engrossment by other processes.”

Dr. Carpenter extends the same *unconscious* or *automatic reflex action* to the feelings of the *emotional* states, and says—

“That our feelings towards persons and objects may undergo most important changes without our being in the least degree aware, until we have our attention directed to our own mental state, of the alteration which has taken place in them. A very common but very characteristic example of this kind of action is afforded by the powerful attachment which often grows up between individuals of opposite sexes, without either being aware of the fact; the full strength of this attachment being only revealed to the consciousness of each when circumstances threaten a separation, and when each becomes cognizant of the feelings entertained by the other. . . .

“We continually speak of the ‘feelings’ which we *unconsciously* entertain towards another, and of our not becoming aware of them until some circumstances call them into activity; so that it would seem as if the material organ of these feelings tends to *form itself* in accordance with the impressions which are habitually made upon it, and that we are as completely unaware of the changes which may have taken place in it, as we are of those by which passing events are registered in our minds (in the memory), until some circumstance calls forth the conscious manifestation, which is the ‘reflex’ of the new condition which the organ has acquired.” *

To the category of the *ideo-motor phenomena* belong, as Dr.

* Dr. Carpenter's “*Human Physiology*,” pp. 609-10, 5th edition.

Carpenter has shown, a variety of aberrant actions, bordering on insanity, of which the history of mankind in all ages furnishes us with abundant examples; and among the most recent, but not the least remarkable instances, is the *table-turning* and *table-talking* epidemic which spread through almost the whole civilized world in 1852-3; and to his able disquisition on the subject the reader is referred.*

After the mind has been pondering over the perplexities of a difficult subject of thought, that the *automatic* or *unconscious reflex action* of the intellectual and reflecting organs should, during a period of repose—that of profound sleep—*evolve clear ideas and new developments of thought* in connexion with the subject, may be truly wonderful; but is it more wonderful that during sleep, when the controlling influence of volition is suspended, a mathematical problem should be solved, than that a poetical fragment like the “Kublakhan” of Coleridge should be composed? Condorcet saw, in his dreams, the final stage of a difficult calculation which had puzzled him during the day; and Condillac, when engaged in his “Cours d’Etude,” frequently developed and finished a subject in his dreams, which he had broken off before retiring to rest. Coleridge says of himself, that his fragment, “Kublakhan,” was composed during sleep, “the images rising up before him as things, with a parallel production of the corresponding expressions, without any sensation or consciousness of effort.” The imagination, it is true, is prone to run riot when the controlling influence of the will is withdrawn, and, as in dreams,—

“To combine a medley of disjointed things—
A court of cobblers, and a mob of kings.”

At all times, indeed, the *imaginative* are less amenable to the dominion of volition than are the *reasoning processes*; but still we must bear in mind the mental relations of the imaginative faculty and the reasoning powers.

Out of the fanciful combinations and groupings of external objects, *new conceptions* are formed; and by the imaginative faculty, ideality, we are placed in scenes, circumstances, and relations in which our actual experience has never placed us, and from which, in consequence, as *new sources* of thought, *new conceptions arise*. But while these new creations may bear strongly the impress of the æsthetic and emotional character and tendencies of our minds, the highest efforts of the creative faculty involve equally the agency of the intellectual powers—of collocation, analysis, and comparison—to achieve their loftiest triumphs. And thus, while, on the one hand, *ideality* is dependent upon

* Ibid. pp. 610-12, 5th edition. 6

the intellectual powers for the development of its highest and sublimest flights; so, on the other, is the *understanding* indebted to the imaginative faculty for those *ideal combinations and conceptions* which, independently of their artistic value and importance, are seen to be so operative in the common affairs of human life,—“suggesting those pictures of the future which are ever before our eyes, and are our animating springs of action, with those visions of enjoyment, never perhaps to be realized, and their prospects of anticipated evil, that often prove to be an exaggeration of the reality—prompting the investigations of science, that are gradually unfolding the sublime plan on which the UNIVERSE is governed, and leading to a continual aspiration after those higher forms of moral and intellectual beauty which are inseparably connected with purity and love.”

Conclusion.—In the attempt, however crude and cursory, which in these papers has been made towards an exposition of some of the leading points of Physiological Psychology, while I may put forward some claim to originality of view, in respect to the nervous apparatus of the perceptive and intellectual consciousness, I am free to confess that I have not hesitated to adopt the opinions and sometimes the language of others, but never intentionally without due acknowledgment, and at all times in the hope of exciting the attention of others, and of rousing into activity the energy of other minds of higher endowments, possessing better opportunities and more leisure for the prosecution of such an interesting and important subject of inquiry.

- The establishment of the “Psychological Journal” has given a new impetus to such investigations; and the philosophy of the mind, like the philosophy of nature, is now cultivated in a manner worthy of its objects. The *phantasms* of Aristotle, the *animal spirits* of Descartes, and the *vibrations* of Hartley, alike have passed away as physiology and psychology have progressed. Still, we are under great obligations to Hartley;* for however unfruitful and visionary his “Doctrine of Vibrations” may be, he appears to have been the *first* in this country, and Bonnet on the Continent, who brought and employed a sound and experimental knowledge of the human constitution to the attempt to discover the physical conditions of sensation and intelligence. I

* “Dr. Hartley’s ‘Observations on Man,’” says Dr. Southwood Smith, “is a work which does honour to human nature. One feels proud to belong to the same order of intelligences with the mind which could compose it. All that relates to the Law of Association, and the whole of the 2nd volume, can never be perused without making the reader better acquainted with himself and with his duties, and more in love with his fellow-beings and with his Creator. The conclusion, on the Final Happiness of all Mankind, is truly worthy of the philosopher, the philanthropist, and the Christian.”—*Illustrations of the Divine Government*, by Dr. Southwood Smith. London. 1822. Pp. 445.

am fully aware how important it is to keep in view the distinctive boundaries of physiology and psychology, and that it is only in their correlations—when certain *phenomena of observation* are found uniformly to co-exist with *certain phenomena of consciousness*—that their direct bearing upon each other can be really established. I am, nevertheless, impressed with the idea that *physiological* bears to *medical psychology* a relationship analogous to that which physiology does to pathology, so that a clear comprehension of the principles of the former appears to me to be essentially necessary for a proper and full appreciation of the abnormal and morbid phenomena of the latter. It has been well observed by Feuchtersleben, in his admirable treatise,—

“Where psychical phenomena appear *abnormal*, there is *mental disorder*, which has its root in the mind, so far as this is manifested through the sensual organs; and has its root in the body, so far as this is the organ of the mind. To search after phenomena in which these relations are revealed, with the unprejudiced eye of experience, to investigate them scientifically in every point that is of importance to the physician, and to collect them into one whole, is the province of medical psychology.”*

The human mind must be studied in connexion with the material conditions of the encephalon, since it is upon the vesicular matter of the encephalic ganglia that the mind is dependent for the manifestation of all its activities in this life. And it has long been my own settled conviction that the metaphysician can make little progress independently of the physiologist, and that it is to the medical philosopher and physiologist we are to look for the most valuable contributions to the science of mind. To be reminded of what they have done, we have only to recall the names of Locke, Hartley, Brown, &c.

The expressive language of Dugald Stewart, in reference to Locke, in his admirable dissertation on the progress of philosophy, admits of general application:—

“No science,” says he, “could have been chosen more happily calculated than *medicine* to prepare such a mind as that of Locke for the prosecution of those speculations which have immortalized his name; the complicated and fugitive, and often equivocal phenomena of disease, requiring in the observer a far greater portion of discriminating sagacity than those of physic strictly so called.”

The praise which our English Hippocrates, Sydenham, the greatest authority of his time, bestows on the medical skill of Locke, affords a brilliant proof of the high estimation which his acquirements in the science of medicine, his penetrating judg-

* “Medical Psychology.” Translated and published by the Sydenham Society. 1847.

ment, as well as his many private virtues, had procured for him from all who knew him. In the dedication prefixed to Sydenham's "Observations on the History and Cure of Acute Diseases," published in 1676, he boasts of the approbation bestowed upon his method by Mr. John Locke, who, to borrow Sydenham's own words, "had examined it to the bottom; and who, if we consider his genius and penetrating and exact judgment, has scarce any superior, and few equals now living."

"Nostri præterea quam huic meæ methodo suffragantem habcam, qui eam intimeus per omnia perspexerat utrique nostrum conjunctissimum dominum Joannem Locke; quo quidem viro, sive ingenio judicioque acri et subacto, sive etiam antiquis, hoc est, optimus moribus, vix superiorem quenquam, inter eos qui nunc sunt homines reperitam, iri confido, paucissimus certe pares."*

In conclusion, I may reiterate what I have elsewhere said:—

"To Locke we are indebted for dispelling the mysticism of the schoolmen. Freed from the tyranny of ancient names, and regardless alike of the Stagyrte and his categories, he discarded the syllogism, and instituted a searching analysis of the phenomena of thought. In the metaphysical world, like the immortal Newton in the mathematical world, he stands forth pre-eminent. No age or nation ever produced two greater luminaries of science. They live in the veneration of their countrymen, and are borne down the stream of time with a reputation ever gathering, and with the triumphs of a distinction that will never die."†

In this essay I have alluded to the illustrious Gall, and his able associate, Spurzheim, as being the founders of physiological phrenology; but it is to Unser and Procraska that the honour is due for having accurately defined the boundaries of the sensorium commune. And since their time, and both in this country and abroad, there have been many labourers in the field, and much has been effected towards a better understanding and a more exact knowledge of the functions and special endowments of the nervous centre of the encephalon.

We must not forget the labours and researches of Rolando and Bellengeri, and still more recently of Matteucci, in Italy,—of Magendie, Serres, Des Moulins, and Flourens in France,—of Tiedemann in Germany,—and of Retzius in Sweden, &c. And while the discovery of Sir Charles Bell marks a new era in physiological science, the researches of his contemporaries, Shaw, Mayo, &c., and in our own day those of Swah, Owen, Marshall Hall, Solly, Todd, Carpenter, &c., have thrown a flood of light upon the subject. Among living physiologists, Dr. Car-

* *Vide* Lord King's "Life of Locke."

† "Physiological Psychology." Commentary, p. 17, *ante cit.*

penter has done more than any other man to specialize the functions of the nervous centres of the encephalon, and through comparative anatomy, by analytical reasoning and strict induction, to advance our knowledge of the physiological psychology of man.

With the labours and researches of Gall and Spurzheim the name of Mr. George Combe is indelibly associated, and will be held in enduring remembrance. His last work, "On the Relation between Science and Religion,"* is worthy of the author of the "Constitution of Man;" for, to use the words of one to whom I am under great obligations, "Every system of philosophy rests in God, as its highest idea and its final aim. To see the DIVINITY as the beginning, the middle, and the end of all things, is the culminating point of *all human thought*. Thus it is the goal, not only of providence, not only of redemption, but also of the no less divine laws of reason itself, that God *should be all in all*."†

* "The Relation between Science and Religion," by George Combe. Edinburgh, 1857. Fourth Edition.

† Morel's "Psychology," p. 253, *ante cit.* One of the most valuable contributions to the Science of Mind which we have in our language.

THE END.

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